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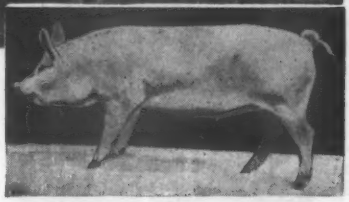

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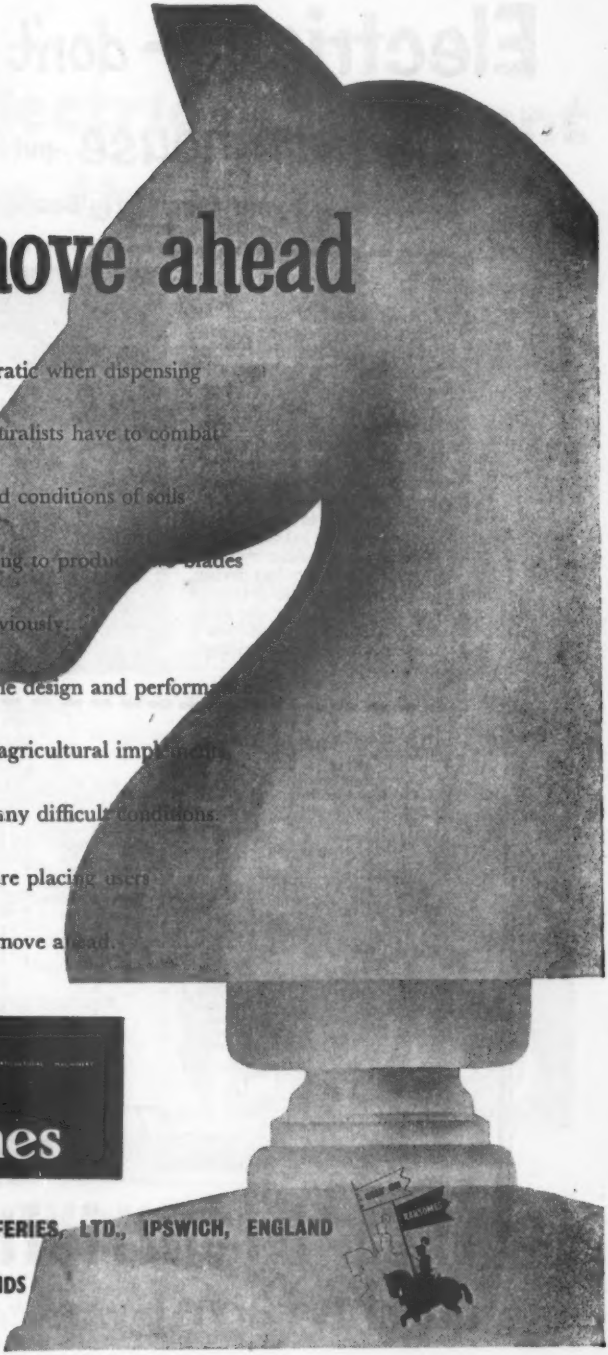

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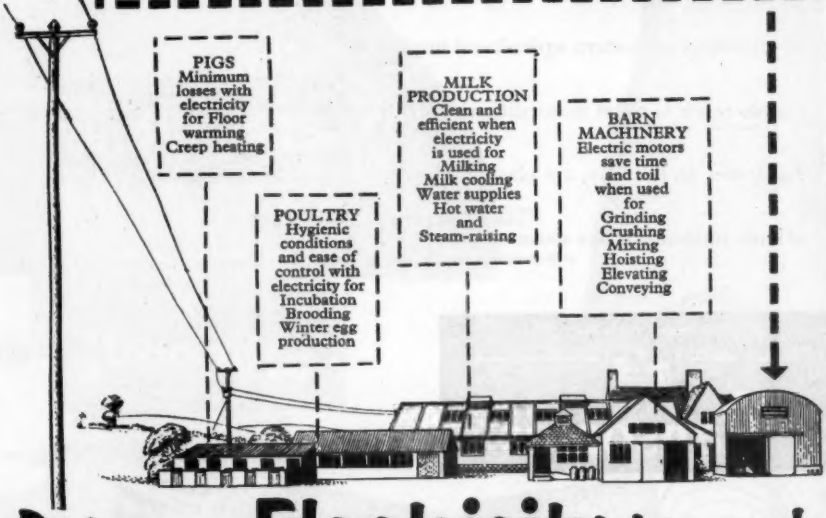
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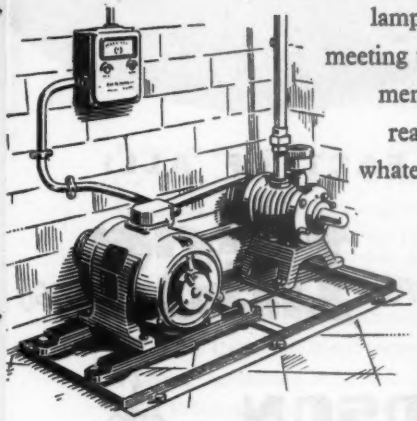

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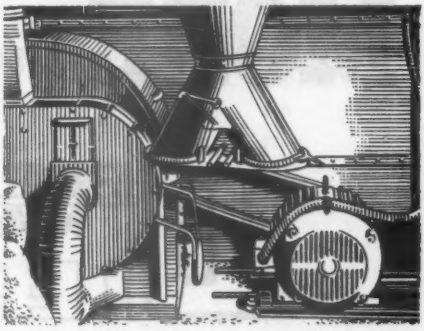

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Cover Photograph

Part of the herd at the Lingfield Secondary School
(see Article on pp. 121-3)

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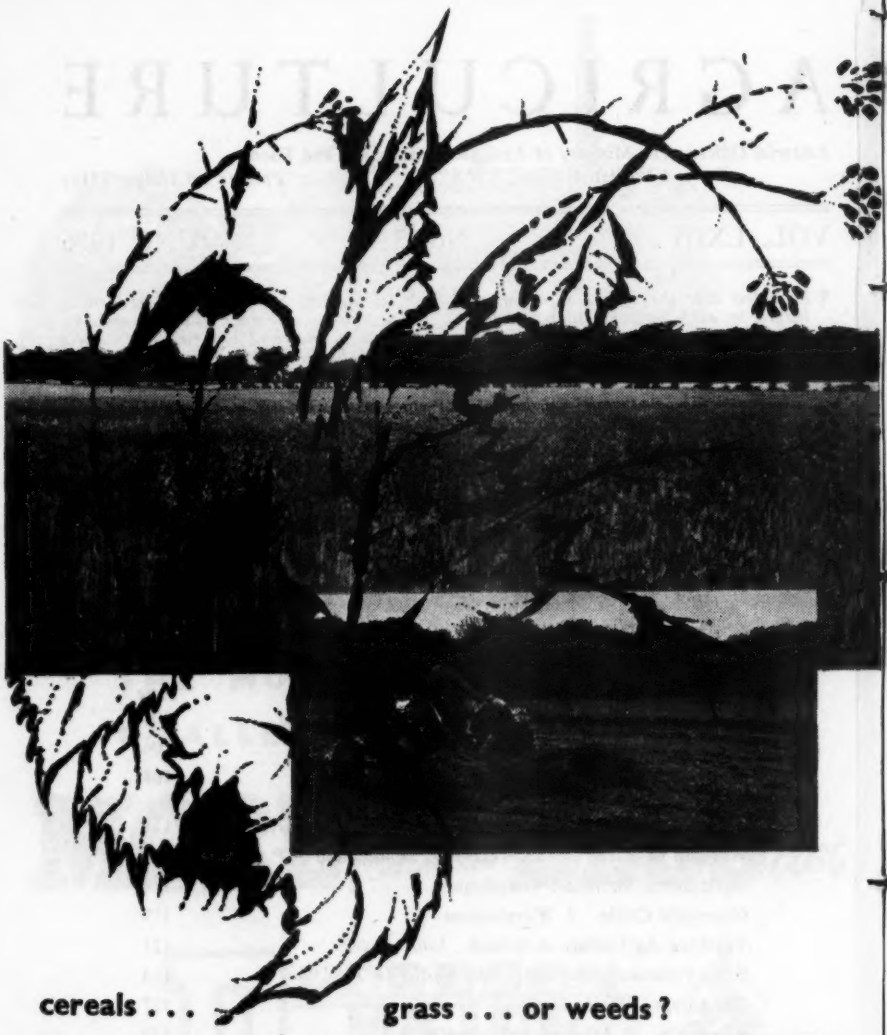

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AGRICULTURE

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FILLING THE SUMMER GAP IN GRAZING

T. E. WILLIAMS, B.Sc.

The Grassland Research Institute, Hurley, Berks

Two things are essential in providing for a reasonable supply of good quality herbage in a dry summer—the right seeds mixture and planned management, especially in spring and early summer.

THE period from midsummer to autumn is one of particular apprehension for the grassland farmer, since the supply of grass can vary within wide limits from year to year, depending on the rainfall during this time. Where it is possible to irrigate grassland, growth is assured, and now that suitable equipment is available, an increase of grassland irrigation is to be expected on those farms with a good supply of cheap water. But there are very many farms where irrigation is out of the question. In such cases the answer lies in wise grassland management, for suitable leys properly handled will go a long way towards alleviating the effect of inadequate soil moisture during the summer months. It is this aspect of the problem that will be dealt with here.

In most years there is a falling off in the supply of grass after the end of June. The reaction of grazing animals, as reflected in a decline in milk production, fattening or growth, may be more marked than would seem appropriate in the light of the grass available, suggesting that the quality or feeding value of the grazing, as well as the total bulk, may be wanting. It is therefore a period for which careful forward planning is necessary in respect of both quality and quantity.

The feeding quality of July and August grazing may be appreciably depressed if old herbage, left by incomplete grazing during earlier months, is present. This material is generally stemmy and fibrous and, although it may help to increase the bulk, it may make the grazing of no more value than a maintenance fodder. Such a practice also depresses white clover, and if continued every year will eventually lead to deterioration of the sward.

Suitable Grasses and Legumes Some species of grasses and legumes produce more summer growth than others. Among the grasses, perennial ryegrass is the least suitable for summer grazing under dry conditions. Ryegrass has a natural tendency to cease growing after midsummer, although it will begin to grow again in early autumn and continue later than any other perennial grass. In the case of the early strains, like Irish and Ayrshire, such growth as is produced in summer tends to be stemmy, and to a less degree Aberystwyth S.24 ryegrass behaves similarly. Although the pasture strain S.23 produces very few flowering stems, it must have adequate moisture to grow well during the summer.

Cocksfoot gives a better summer growth than other grasses and, provided it has been grazed or cut in the second half of May, practically no flowering heads are produced and summer growth is leafy. The bred leafy strains are most suitable. Under lowland conditions on reasonably fertile soils, Aberystwyth S.37 would be an appropriate strain to produce summer grazing. Meadow fescue does not produce such an abundant summer growth as cocksfoot, but it is better than perennial ryegrass. It has the advantage over cocksfoot in that it is more palatable and combines better with white clover. These properties of meadow fescue have no doubt been the cause of the wider use of this species in recent years, either alone with white clover, or, more frequently, incorporated with companion grasses, such as timothy or cocksfoot, or both.

Of the herbage species which can be grown in Britain, lucerne is the most drought-resistant. By far the greatest acreage is found in south-east England —that is, south of a line from the Wash to the Isle of Wight. There is, however, both the need and the scope to extend this crop to other parts of the country. Even where it is already a familiar crop, the area devoted to it could well be increased. The vigorous recovery, after cutting or grazing, of the Flamande strains from northern France is a strong recommendation for the use of these kinds, and the most productive of lucernes for English conditions are found within this group of strains. The best known among them is du Puits, but there is little to distinguish it in productivity from other strains such as Ormelong, Chartrain Villiers or Socheville.

Suggested Seeds Mixtures In providing summer grazing, the maximum use should be made of the particular value of a species at a specific time. The use of simple mixtures is thus most essential. In the case of grass-clover swards, the most widely used and successful mixture is cocksfoot and white clover, particularly in those areas which regularly have dry summers. Under rather less exacting conditions a mixture of meadow fescue, timothy and white clover may be used or, equally well, a mixture of cocksfoot, meadow fescue, timothy and white clover. On the smaller farm, where the number of fields or paddocks available for grazing, haymaking and silage-making is restricted, this last mixture may be used as the only one for all purposes. It will give great flexibility in the management and use of the whole grassland area.

Lucerne is best in a mixture with either cocksfoot or meadow fescue, since the presence of a grass improves its palatability. Suitable seed rates are 14-16 lb of lucerne and either 2-3 lb of a leafy hay strain of cocksfoot or 4-5 lb of S.215 meadow fescue. Cocksfoot may be used on any class of soil, provided that, when necessary, management is directed towards keeping this aggressive grass in a suitable proportion to the lucerne. It is better to restrict the use of meadow fescue to the more fertile and heavier soils.

Management for Summer Grazing Even when composed of suitable species, the ley will not automatically give summer grazing unless the spring and early summer management is suitable. Cocksfoot leys, and those mainly composed of meadow fescue, produce the greatest amount of summer grazing if they are put up for silage in the spring and cut towards the end of May (as they should be to produce high quality silage). This period of uninterrupted growth in May will produce a strong plant which will give a vigorous aftermath. The new growth should be further augmented by a dressing of 2-3 cwt per acre of a nitrogenous fertilizer applied immediately after cutting for silage. With a complete rest from the end of May or early June, good grazing should be

available by mid-July at the latest. If it is not required at this time, grazing could be delayed for another fortnight.

With the best of management, grazing is not normally plentiful in July, and strip grazing with electric fencing will help in the economical use of the herbage. A back fence may well be worth while, as the amount of fresh growth that will be put up after grazing, even in dry summer weather, is surprising. This regrowth will be greater where the back-run is restricted so as to prevent cattle grazing the grass when it is just beginning to grow.

If it is intended to produce summer grazing from cocksfoot or meadow fescue leys after stock have been on them in May, care should be taken that the spring grazing is not hard or continuous; otherwise results will be disappointing. It pays to mow off the ungrazed herbage towards the end of May and then rest the leys from grazing in June, when a nitrogen dressing at the rate of 2-3 cwt per acre should be given.

The management of lucerne leys for summer grazing is straightforward. If it is anticipated that grazing will be required by mid-July, the lucerne should be first cut for silage or hay in the second half of May. This would allow six weeks of uninterrupted growth afterwards, which is necessary if the lucerne is to maintain its vigour. Strip grazing with an electric fence is a necessity with lucerne leys, and no more than a three- or four-day run back should be allowed. Thus a back fence is essential: it will ensure that another grazing or cutting can be obtained by mid-September. Generally speaking, cattle will not graze lucerne close to the ground and probably they should not be forced to do so. The loss is almost entirely that of stem, and with milking cows or feeding animals it may as well be left on the field.

Summer grazing of lucerne-grass leys tends to increase the proportion of grass. To prevent the grass attaining such proportions as to smother the lucerne, it is best to graze such leys at some period between November and February with outlying cattle, or better with both cattle and sheep. No grazing or cutting should be practised between the third harvest (either grazed or cut) in mid-September and the time when frosts cut down the growth of lucerne towards the end of October or early November.

There are a few other possibilities for valuable summer grazing. Thus, in all but the driest years, a ley sown without a cover crop will give good grazing in late summer and autumn, particularly if some Italian or short-rotation ryegrass is included in the mixture. Such newly-sown leys have a very beneficial effect on milk production. Sainfoin leys, too, can be relied upon to give good aftermath grazing, and the one-year ley, containing red clover, which has been cut for hay, will provide a grazing or two before ploughing up in the autumn.

One or More Mixtures? In many circumstances there is no real necessity for a variety of mixtures. Thus, as suggested earlier, one general-purpose mixture, consisting of meadow fescue, timothy and white clover, with or without cocksfoot, may be used on all fields. Main reliance is then placed on management, which would include silage-making, to provide the area and growth for summer grazing. A longer grazing season would be got from a wise combination of ryegrass leys—using early species and strains—and cocksfoot leys. The latter could be relied upon for a silage cut in May and for summer grazing, and the former for spring, early summer and autumn grazing. Lucerne-grass leys are most necessary in the drier areas and on those soils least retentive of water, but this does not mean that lucerne is a crop which should be restricted only to such situations. It will play a valuable role in a wide range of conditions.

FILLING THE SUMMER GAP IN GRAZING

It will be apparent that the provision of summer grazing, in the drier parts of the country and in a dry summer, demands ley farming. It is also most easily catered for where silage-making is a part of the farming scheme. Where both are practised, the provision of adequate summer grazing falls easily into a general scheme of grassland farming.

OUR GRASS AND OUR CATTLE

J. PEARCE, PHD., N.D.A., N.D.D.
University of Reading

Better grass, intensively managed without waste, can cut the concentrates bill appreciably.

THE improvement of grassland has been the focus of considerable attention during the past ten to fifteen years. Farmers have been constantly urged and encouraged to produce more and better grass, and there is ample evidence that on the great majority of farms the standard of grassland management has steadily risen. There are good and urgent reasons why this process should continue and, in fact, why the rate of progress should accelerate. Over half the cultivated land of Great Britain is under grass and there is also an immense area of rough grazings. In no other crop is there such scope for increasing production. The wide variation in the productivity of grassland that exists from farm to farm supports the claim that if all our present knowledge on grass production could be applied generally, then it would not be unreasonable to expect an increase in grass yield of at least 20 per cent. In addition, there is a growing realization that in terms of cost per unit of animal food produced, grass is cheaper than any other crop. The cheapness of grass is perhaps best illustrated when compared with purchased concentrates, for grass can provide the same quantity of animal nutrients at about one-sixth to one-third of the cost.

From a national point of view, the urgent need to improve our grassland and to cut down the expenditure on imported animal feedingstuffs cannot be ignored. For the individual farmer the subject is likely to be a vital one in the face of generally rising costs on the one hand and the pressure to keep down the prices of livestock products on the other. There is, in fact, overwhelming evidence that one of the main factors on which the future success of our agriculture depends is the extent to which farmers can make greater use of the grass crop. Unfortunately, information on the efficient *use* of grass is sadly inadequate, compared with that on grass production. Nevertheless, the problems presented in making the best use of grass are being tackled energetically and a considerable amount of useful work has already been done.

One of the main problems concerning the efficient use of grass is the need to maintain a relatively even supply of livestock nutrients in the face of considerable seasonal variation in grass production. This difficulty can be overcome to some extent by the use of different types of leys and by the complementary use of methods of grass conservation with grazing management. The autumn sowing of Italian ryegrass for early spring grazing is now a common practice on many farms. The lucerne mixture ley can be a great standby in dry seasons, and it also provides good grazing in the autumn and

winter if given an adequate period of rest beforehand. If the use of different types of leys is combined with the intelligent application of fertilizers, then the grazing season can be extended at both ends. In addition, the growing practice of taking silage or hay cuts to skim off surplus grass in flush periods of growth not only provides additional winter feed, but also helps to maintain the grass in better condition for grazing at a later date. To let the grass get away from the stock is bad for future grass production, but what may be of even greater importance is the marked reduction in the efficiency of utilizing the grass that follows.

Rationed Grazing promotes Utilization Of all the important advances in grazing technique in recent years, perhaps the most outstanding has been the introduction of rationed grazing using the electric fence. The principles of rotational grazing have long been accepted, and the advantages of this system over extensive methods of grazing is unquestioned. The use of a system of rationed grazing, however, has been shown to give an improvement in utilization of from 20 to 30 per cent over good rotational grazing. The effect which such an increase in efficiency is likely to have on stock-carrying capacity is readily appreciated, and yet there are many farms where grazing is still on the extensive basis. One of the main problems presented by rationing grazing is the soiling of the herbage by the stock. As the intensity of grazing increases, soiling is likely to become of greater significance; especially so, after the second grazing. Obviously, the best solution is to allow the grass to grow away for hay or silage at some stage during the grazing season—an advantage in itself, since it adds to the store of winter keep.

On some of the best farms, systems of rationed or strip grazing have been developed to such an extent that grass fields are split into two or more sections, and strip grazing alternates with cutting for hay or silage, as the supply of grass determines. Under this system the problem of grass becoming too mature in front of the stock is overcome and, at the same time, soiling is reduced. The main problem involved is in providing easy access to water, but in many cases this difficulty has been solved by the use of flexible piping and portable drinking units. The use of the back fence in systems of rationed grazing is obviously an advantage where fields are large in relation to the numbers of grazing stock. The back fence prevents overgrazing of part of the field, and it may well help to reduce the incidence of soiling.

For the dairy farmer, some system of rationed grazing is essential. The cow is thus regularly provided with fresh, clean herbage and this ensures a steady intake of high quality green material. It is important, however, that the electric fence should be moved at least once, and preferably twice, daily so that the cow is not faced with a fluctuating supply of grass which could result in variation of milk yield.

Where store and fattening cattle are concerned, the position is less clear. Many graziers believe that fattening cattle do best on a system of set stocking. But there is no conclusive evidence to support this contention. On the contrary, there is ample proof that a system of rationed grazing for beef cattle will give higher liveweight gain per acre, and it has also been shown that the system is not detrimental to daily liveweight gains. Nevertheless it is unwise to ration the grazing too strictly for this class of stock, since the beef or store animal, unlike the dairy cow, spends the full day on grass, and a temporary shortage of grass is likely to lead to breaking out. At the same time, very frequent moving of the fence may not be justified for store and fattening beasts, in view of the extra labour cost involved. Evidence is lacking on this particular point.

The Problem of Feeding Value In making more intensive use of grass, the farmer is faced with the problem of determining the area of grass to be presented to the stock on a system of rationed grazing. There is also the difficulty of assessing the feeding value of the grass so presented. Unfortunately there is no reliable method of measurement suitable for general application. The point is a serious one where dairy cattle are concerned, for from time to time decisions have to be made on the amount of other food to be used to supplement the grass. Methods of estimating the output of grassland in terms of grazing days or utilized starch equivalent are of little assistance, since the answers they give are retrospective: they may, however, form a useful experience for future estimations. On the whole, most dairy farmers try to judge the value of the grass by its effect on milk yield and on the general condition of the stock. While this may prevent underfeeding, it often leads to an uneconomic use of concentrates. There can be little doubt that on many dairy farms the value of grass for milk production is grossly underestimated, especially in the period from the beginning of May to the end of June. A study undertaken on a number of dairy farms in southern England seemed to indicate that estimates of utilized starch equivalent obtained from grass were often low because of overfeeding of concentrates, rather than because of the poor quality of the grass.

Compared with pre-war days, it is now becoming increasingly difficult to make good use of the feeding standards available. Grass and other bulky food now forms a much greater proportion of the total diet of cattle. If grass production is to increase to any marked extent, then the problems of rationing and feeding of cattle are likely to become greater in the absence of precise information. There is obviously a growing need to revise feeding standards in the light of changing conditions.

Bulk in the Ration The problem of bulk in the ration is of major importance, especially where the higher yielding dairy herds are concerned. There is, however, some difference of opinion on the question of bulk in the ration and the capacity of the animal to deal with such material. The bulkiness of a food may be expressed in terms of volume or dry matter or fibre content, but it seems likely that the capacity of the animal is very much affected by the condition of the food and by the time taken for it to pass through the digestive system. If this is true, then the capacity of an animal to deal with herbage or well-made silage may well be greater than is generally supposed, for these two foods should pass through the digestive system fairly quickly. How far the rapidity of movement of food through the digestive system affects the efficiency of its metabolism is rather uncertain. At the same time, animals at grass take in their food in smaller amounts at frequent intervals, and this must certainly help in dealing with bulky material.

Studies of the behaviour of cattle at grass have shown that grazing animals are very sensitive to changes in the quality and quantity of the herbage available. There is a close correlation between an animal's intake of grass and the time it spends in grazing. It has been shown that cows spend a longer time grazing on young herbage than they do on less leafy and more fibrous material. The reason for this may be that the rate of passage of young herbage through the digestive system is quicker than that of larger and drier material. The importance of good grassland management is thus clearly indicated. In this connection there is conclusive evidence that cattle grazed on a good rotational or rationed basis are less selective in their grazing and that they take less time to satisfy their appetites.

OUR GRASS AND OUR CATTLE

In the process of making more intensive use of grass, attention has been directed mainly towards the grass itself, rather than on the grazing animal. This is natural in view of the complexity of the animal problems, but a stage has now been reached where further progress will largely depend on solving some of the problems encountered on the animal side. The question of palatability is obviously an important one, especially where the animal is required to eat large quantities of bulky material. Where an animal is allowed to be at all selective in its grazing, there can be little doubt that choice is determined largely on the basis of succulence, rather than on, say, chemical composition. In other words, the grazing animal will almost always prefer the younger growth, although there are times when some more mature material seems to be desired—especially where there is an abundance of watery and succulent grass. In general, however, intake of bulk depends on the stage of growth of the grass.

From time to time the suggestion has been made that it should be possible to select strains of cattle most capable of making the best use of grass and bulky foods generally. This, however, must be a slow process, and in fact there is little or no evidence that there is any great variation between animals of a particular breed in their adaptability to intensive grass feeding. On the other hand, the study of animal behaviour on grass is still only in its infancy. Who knows what may develop as the work proceeds? It has been suggested that more spectacular results would come from persuading more farmers to adopt systems of intensive grass husbandry than to study the habits of their grazing stock.

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★ ***NEXT MONTH***

The July issue will be linked with subjects of interest in the Royal Show area, and will include articles on Northumberland and Cumberland Farming, Meat from the Hills, Three-way Crossing, and the Chillingham Herd.

MERCHANTS' CREDIT

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Many farmers find the merchants' discount system a valuable source of short-term credit. But, as Dr. Cracknell points out, it can sometimes be most expensive. Since all kinds of credit are scarce at the present time, the farmer may have little freedom of choice, but the comparison will be worth remembering.

MERCHANTS' credit is an important source of short-term credit to agriculture, and farmers appreciate its advantages. It is, however, necessarily expensive, and this article has been written in the belief that more farmers would try to settle their bills promptly if they realized just how expensive this type of credit can be. Merchants' credit may be used without any of the formalities associated with the bank overdraft, and the farmer does not have to disclose his financial position or provide any security. Some farmers may use merchants' credit because they have reached the limit of their overdraft with the bank, but there are others who delay paying their bills merely from habit and not because they are short of money. Often a farmer will use merchants' credit because he prefers to keep a cash reserve in case any more pressing need arises; he knows that he can usually prolong his credit with the merchant—if necessary for some months. Whatever his circumstances, the average farmer makes full use of merchants' credit and regards it as a normal incident in his farming operations.

The Discount System Merchants as a whole would probably much prefer to conduct their business on a no-credit basis. The more money the merchant receives promptly the more trade he can do on the same capital. Moreover, during a period of monetary inflation, payment for goods six months to a year after they are supplied is particularly bad business for him, since although he receives back the same amount of money, it will not buy the same amount of goods next time. However, so long as their customers want credit terms merchants have little choice but to comply. Rather than make a direct interest charge on overdue accounts, they generally prefer to put the emphasis on encouraging prompt payment by offering a cash discount.

Sometimes the discount terms are printed on the invoice, as, for example, "You may deduct 20*s*. per ton if paid within one calendar month from delivery date, or 10*s*. per ton if paid within two calendar months." Alternatively, the merchant may do the calculation himself and simply state: "You may deduct £..... if paid by.....(date)." For fertilizers, a sliding scale of discounts is usually offered—for example, 12*s*. per ton for payment within one month, decreasing by two shillings a month up to the sixth. The term "within one month" can, in fact, mean anything up to eight weeks, since it will often extend to the end of the month following that in which the goods were delivered. The precise form of the discount has endless variations, but the implied assumption throughout is that the buyer will not pay his bills promptly, and the price is therefore fixed to include the interest charge.

The discount system suits the merchant because he is spared the task of calculating the interest on overdue accounts, and the farmer likes it because

if he earns the discount he probably feels that he is obtaining his goods "cheaply". Even if he loses the discount, he is only paying the price quoted on the invoice, and he will probably not realize the high interest charge incurred. He probably confuses the discount rate with the rate of interest, whereas in fact, of course, the bank levies its charges at a "per annum" rate of interest. If the discount rate is put on to this basis it looks very different. A discount of 5 per cent, for instance, will represent an annual rate of interest of 21 per cent per annum if the bill is paid three months after the delivery of the goods. It is only fair to add, however, that the farmer quite often deducts the discount even though he pays after the time allowed. In such circumstances the merchant, for reasons of goodwill, does not always pursue the matter any further. Quite often, too, the merchant and his farmer-customer will come to a special arrangement concerning the regular payment of bills, under which the farmer may secure considerably more favourable discount terms than those currently charged. It is clearly to the advantage of the farmer to do this if he can, and the merchant is glad to have an assurance of regular payments.

There are very good reasons why merchants' credit is expensive. Generally speaking, an agricultural merchant cannot offer credit facilities to his customers without first obtaining credit himself, at an annual rate of interest of, say, 6 or 6½ per cent. Furthermore, he is likely to have a considerable number of bad debts, and in an adverse season these may cause a severe drain on his resources. Considerable clerical work is also involved in keeping account of credit sales and sending out repeated reminders. For these reasons, the rate of interest on merchants' credit is necessarily higher than that of a bank.

Calculating the Rate of Interest The farmer can quite easily work out for himself the annual rate of interest on merchants' credit. There are many forms of discount terms, and only one example can be given here, although it is not necessarily typical. Say he buys one ton of feedingstuffs at £30 per ton, and a credit charge of £1 10*s.* per ton is added to the invoice, which thus becomes £31 10*s.* What "per annum" rate of interest does the £1 10*s.* represent? The answer is that this will depend on how soon the farmer pays the bill. If he pays within two months the interest charge would be £1 10*s.* on £30 for two months—that is: $\frac{1.5}{30}\times 100\times\frac{12}{2}=30$ per cent. If he pays within three months, it becomes: $\frac{1.5}{30}\times 100\times\frac{12}{3}=20$ per cent. If he does not pay until the twelfth month, then the rate of interest is, of course, only 5 per cent.

The calculation can be reduced to a simple formula where D = total value of discounts lost when the bill is paid; M = the number of months between delivery of goods and date of payment; and B = gross value of bill less full discount obtainable.

$$\text{Annual rate of interest} = \frac{1200\ D}{MB} \text{ per cent}$$

The annual rates of interest in this example are as follows:

Number of Months between Delivery of Goods and Payment of Bill	2	3	4	5	6	7	8	9	10	11	12
					per cent						
Interest per annum	30	20	15	12	10	8.6	7.5	6.7	6.0	5.5	5.0

The cost of merchants' credit obviously declines as the credit period lengthens, and may be no more than bank credit if the merchant allows an account to remain outstanding for a full year. But, of course, the merchants

are anxious to discourage this, and they often insist on payment within 3-6 months. Sometimes from the sixth month onwards they charge an additional 1*d.* or 2*d.* in the £ for each month the bill remains outstanding. The important point is that unless a merchant is prepared to extend the credit term to one year without making an additional charge, it would almost always be cheaper for a farmer to borrow from a bank (if he can do so) rather than lose his discounts. As to the farmer who has the money but forgets, or just does not bother to settle his bills promptly, he is paying heavily for his negligence.

A Significant Item The significance of such heavy interest payments may best be illustrated by a practical example. Let us assume that an intensive poultry farmer buys 3 tons of feedingstuffs every month at a cost of £100, at discount terms of 2*s.* per cwt for payment within one month. Assuming the farmer has to borrow the £94 to pay the first bill (that is, £100 less £6 discount), the following figures show that it would pay him, if he possibly can, to borrow from the bank for one year rather than lose his discounts:

Trade Credit	Bank Credit
Value of discounts lost = [2*s.* × 60 × 12 = £72]	Interest on £94 for one year at 6½ per cent = £6 2*s.* 2*d.*

Of course, these two figures are only directly comparable if the farmer pays each of his bills just after one month from the delivery of the goods, since the total sum "borrowed" on merchants' credit would only be £94. If, as is more likely, the farmer did not pay his bills until after, say, three months, then he would in fact be "borrowing" £282, and the comparable bank interest on this amount would be £18 6*s.* 6*d.* But this is still very much less than the value of discounts lost.

Most farmers probably tend to regard merchants' credit as an insignificant item in relation to their costs as a whole. Whilst this may be true if bought feeds, seeds and fertilizers account for only a small percentage of total costs, it is not so if these items are at all significant. To illustrate this, an example is given below which is based on actual figures for an intensive pig producer on a small farm in Devon who bought most of his feedingstuffs from the local farmers' co-operative society. The bonus is included with the trade discount, because it would also have been forfeited if bills had not been paid within one month.*

	£
Total revenue plus valuation increase	7,500
Total expenses (of which £4,750 represents feedingstuffs) ...	6,980
Net Farm Income	520
Included in Net Farm Income	£
Total trade discounts earned	118
Total co-operative society bonus	120
Total	238
Discount and bonus as percentage of net farm income ...	40
Discount and bonus as percentage of total expenses	3½

This example shows that trade discounts and bonuses can amount to a significant percentage of the profit, even though they may represent only a

* This is now a quite common practice amongst co-operative societies dealing with farmers' requisites.

small proportion of total expenses. The farmer who does not, or cannot, take maximum advantage of trade discounts and bonuses is in effect paying a higher price for some of his most important basic materials than the farmer who does.

Less Credit—More Profit Merchants' credit has established itself as an important and valuable source of short-term agricultural credit, and has probably received less adverse criticism in the last decade or two than any other source of credit. Its advantages, however, are more apparent than its cost. The need to reduce costs of production is urgent and more restraint in the use of merchants' credit could make a modest, but by no means insignificant, contribution to this end, and a considerably bigger contribution to the net farm income.

Acknowledgment is gratefully made to Mr. S. T. Morris, Provincial Agricultural Economist, University of Bristol, for his help in the preparation of this article.

FORMALIN-TREATED SKIM MILK FOR PIGS

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The results of preliminary tests indicate that small quantities of formalin added to stored skim milk will delay clotting for some weeks. Milk so treated was fed satisfactorily to fattening pigs and the bacon produced from them was normal in flavour.

IT is well established that skim milk may be fed satisfactorily to pigs, either fresh or completely sour. Where the pig-keeper obtains deliveries of skim milk once or twice a week, the feeding of consistently fresh milk is not practicable, and the normal procedure is to allow the milk to clot in storage tanks and then distribute it in buckets to the pigs. Clearly, it would save labour if the milk could be piped from the storage tanks direct to the troughs, but to make this possible some means of preventing the milk from clotting, and hence blocking the pipes, would be necessary. The preliminary tests reported here were carried out to investigate whether the addition of small quantities of formalin to the milk might arrest bacterial growth sufficiently to prevent clotting in the stored milk, at least for a limited time, and to determine whether such treatment would affect the nutritive value of the milk for fattening pigs.

Clotting Tests Three 50-gallon galvanized iron tanks, fitted with outlet valves, were installed in a building having a thermostatically controlled temperature of 60-65°F. Each tank had a loose-fitting lid. The aim of the first test was to find out how long skim milk, to which various concentrations of formalin had been added, could be kept in the tanks without clotting. Twenty-five gallons of skim milk were put in each tank, and sufficient formalin* to make final concentrations of 0.1, 0.2 and 0.5 per cent respectively in the three tanks was thoroughly mixed into the milk. Approximately 3 gallons of milk were drawn off from each tank daily, leaving, at the end of the week, about 4 gallons of milk in each. Twenty-five gallons of a

* Formalin = 40 per cent solution of formaldehyde gas in water.

fresh lot of skim milk were then added weekly to each tank, together with the appropriate amount of formalin.

The interval before the milk eventually clotted in each tank was as follows:

Tank	Percentage Formalin	Weeks to Clotting
1	0.1	4
2	0.2	6½
3	0.5	6½

A second test was then started with Tank 3, using the same routine. After the tank had been emptied, thoroughly cleaned and steam sterilized, a further 25 gallons of milk with 0.5 per cent formalin was added, milk being run off daily for use in a pig-feeding trial described later. In this test the milk remained unclotted for 6 weeks, and, in a third test, for 9½ weeks. The longer period before clotting in the last test was probably associated with a change in the source of the skim milk—a factor that is considered in more detail later.

For the subsequent tests with Tanks 1 and 2, the routine was changed, in that at the end of each week the milk remaining was drained off and the tanks rinsed out with cold water, but not scrubbed. To the fresh supply of milk put in the tanks each week, 0.1 per cent formalin was again added for Tank 1 and 0.2 per cent formalin for Tank 2. The length of time (in weeks) before the milk clotted in these two tanks was as follows:

Test	1	2	3	4
Tank 1 (0.1% formalin)	8	16½*	—	—
Tank 2 (0.2% „)	5	3	2	12½*

*Test concluded without milk clotting

For the final tests of all concentrations of formalin, the skim milk used was obtained from the Institute dairy, whereas for the previous tests it had come from a factory twenty miles away. The much longer periods that the milk kept without clotting with all three concentrations of formalin when the Institute milk was used was probably connected with the shorter interval between separating and the addition of the formalin. Differences in the quality of the milk may also have played a part.

In all tests with the three concentrations of formalin, a greenish mould quickly formed on the surface of the milk in the tanks. For example, in the final test of the 0.2 per cent formalin milk, this mould had appeared by the end of the first week and remained for the entire 16½ weeks of the test.

Pig Feeding Trial The facilities available precluded the comparison of all three concentrations of formalin used in the clotting tests in a feeding trial with pigs. It was therefore felt that, in the first instance, the suitability for fattening pigs on skim milk containing the highest concentration (0.5 per cent) of formalin and stored in the way described above, should be determined.

Four pairs of litter-mate pigs 9-11 weeks old at the start of the test were selected from three litters and were housed in individual pens in the experimental piggery. They were fed twice daily a meal mixture consisting of 75 per cent barley meal and 23 per cent fine millers' offal, with a mineral and vitamin supplement added. Water was freely available in a separate trough. The skim milk allowance was mixed with the meal in the trough immediately before feeding.

It was intended when the experiment started that each pig should be given one gallon of skim milk a day—one of each pair to receive fresh skim milk

(stored in a refrigerator) and the other the skim milk preserved with 0.5 per cent formalin. The quantity of meal given was based on weight, and a reduction of 1 lb of meal from the normal all-meal feeding scale was made for every gallon of skim milk consumed. However, whereas the pigs given the fresh skim milk readily consumed their full daily allowance of 1 gallon, the pigs given the milk with added formalin refused a large proportion of it, and the daily allowance was reduced to ½ gallon. Even this quantity was not fully consumed for some time and, in fact, it was not until the pigs had been on experiment for about nine weeks that the full daily allowance of 1 gallon of the 0.5 per cent formalin milk was consumed. Apart from this dislike of the milk, the pigs remained thrifty and grew at a reasonable rate, although more slowly than the pigs given the fresh skim milk. During the final eight weeks of the experiment both groups of pigs grew at a similar rate. The results are summarized below.

Average Weight of Pigs

	Fresh Skim Milk	0.5% Formalin Skim Milk
	lb	*lb*
Initial weight	37.5	37.8
After 9½ weeks on experiment	106.0	87.8
After 17½ „ „ „	195.0	173.8

After a further week on the formalin skim milk, milk feeding had to be stopped for eleven days owing to a breakdown in the supply. The pigs were, however, given the formalin milk again for the final week of fattening.

The carcasses were examined after slaughter and no obvious abnormalities or taints were observed, all pigs grading well. After curing, samples of bacon from the sides were distributed to a number of people for tasting, and all reported that they found the bacon very acceptable without any off-flavours.

The results of this experiment indicated, therefore, that skim milk preserved with as much as 0.5 per cent formalin could be fed satisfactorily to pigs in the later stages of fattening, but not to younger pigs.

Formalin in Commercial Use Experience in the use of formalin in skim milk was obtained on two commercial farms during the early summer of 1955. The milk was stored in 500- and 1,000-gallon open tanks, and it was found that the addition of formalin at the rate of 0.1-0.2 per cent was sufficient to prevent the milk clotting for the required 8-9 days between deliveries of milk. Between each batch of milk the tanks were scrubbed out with a broom and cold water, followed by a thorough scrubbing with a mixture of 1 pint of hypochlorite in 20 gallons of water on one farm, and 1 pint of formalin in 2 gallons of water on the other.

The milk was fed at the rate of up to 2 gallons a day per pig from weaning. On both farms some vomiting occurred in the younger pigs receiving the milk, but this did not appear to have any ill-effects, and the full allowance of milk was readily consumed. When the milk was fed four times a day instead of twice on one of the farms, vomiting ceased.

Although no control pigs were available for comparison, the general opinion on both farms was that the pigs " did " very well on the skim milk with added formalin, and that the use of formalin as a means of preventing clotting for a limited period (so enabling the milk to be piped to the pigs) was a great success.

In conclusion, we may say that the use of formalin in skim milk is likely to have distinct possibilities, although more extensive trials are clearly needed. For example, the trials at Shinfield showed that when the tanks were merely rinsed with cold water once a week, clotting did occur after

varying periods. Something more than this routine would therefore be needed to prevent it. Further information is necessary to determine whether the improved methods adopted on the commercial farms for cleaning the tanks between each batch of milk are adequate to enable the routine to be continued indefinitely.

We wish to thank Mr. D. Rowe, Assistant County Agricultural Officer, Somerset, for the information concerning the trials on the two commercial farms.

WHIPTAIL OF EARLY CAULIFLOWERS

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The results of observation trials in Worcestershire suggest that heavy dressings of fertilizers on acid soils will accentuate whiptail in early cauliflower when molybdenum is deficient in the soil or is not available to the plants in sufficient amounts.

EARLY cauliflowers are an important crop on many intensive market gardens, over 5,000 acres being devoted to them every year in England and Wales. This crop calls for a high capital outlay in glass, and absorbs a lot of skilled labour from sowing-time in late September to marketing in the following June. Sown under glass either in autumn or very early in the following year, the plants spend 3-6 months of their life under cold frames or in the glasshouse, usually in 3-inch pots, before being put out in the field in March. Because of the heavy costs in the early stages, any losses due to pest, disease or other cause can quickly turn the possible profit from growing early cauliflower into a certain loss. Growers have been quick to note and take advantage of the latest work on pest and disease control, but, on many holdings, losses also occur every year from other causes. Of these, whiptail has been the main problem for some time and a subject for investigation by research and advisory workers in several countries.

Whiptail may occur in young plants before or after planting out, but more frequently it is noticed when the plants have been in their cropping positions for some weeks. The leaves of affected plants are deformed, the leaf blade fails to develop normally, being lobed, indented or scalloped in outline and much reduced in breadth. In severe cases, only the main rib develops—hence the name "whiptail". Blindness or abortion of the growing point may follow in varying degrees, and in badly affected plants the central growths decay and die. Occasionally plants showing these leaf and growth symptoms recover and grow on to produce a small imperfect curd. The term "pseudo-whiptail" has been used by some workers to describe such plants. We suggest that this term is confusing and that "temporary whiptail" might be a more appropriate name where plants recover after a time.

Some research workers appear to have reserved the term "whiptail" exclusively for cases connected with molybdenum deficiency, and for use only when affected plants are growing on acid soils, when molybdenum deficiency

is highly probable. In our view, the term " whiptail " should be regarded as a description of a symptom picture, not necessarily attributable to one cause alone but covering all cases of these deformed plants, whatever the origin.

Most investigations on whiptail in cauliflower carried out in this country have been concerned with the appearance of the phenomenon in plants grown on acid soils, when it appears that cauliflower plants are unable to utilize enough molybdenum. Dr. Plant (1) has shown that the addition of lime to acid soils increases the availability of molybdenum in the soil. Investigations by Hewitt and Jones (2) indicate that there is a connection between the form in which the plant receives or takes up nitrogen and the need for molybdenum. Three Dutch workers (3) suggest that molybdenum is necessary for the reduction of nitrate as a preliminary to forming protein in the plant, and that when plants absorb nitrogen in nitrate form they have a greater need of molybdenum.

Effect of Soil and Weather Investigations by the N.A.A.S. in Worcestershire in 1953 and 1954 showed that soil samples taken immediately beneath whiptail plants gave a pH reading of less than 6.5, whilst samples taken from under normal plants were above that figure. In one case, a grower planted two different fields with plants raised from the same packet of seed in the same compost and the same glasshouse. In one field having a pH of 7.23 all the plants were normal in growth, whilst in the second field (pH 6.25), which received the same manuring, about one-quarter of the plants produced were whiptailed. It seemed reasonable to believe that the failures in the second field were due to some factor which was effective only after the plants had been planted out, and this may have been related to the soil acidity.

In addition to soil acidity, other environmental factors concerning the soil and atmosphere have been blamed for the occurrence of whiptail: for example, severe frosts, very cold winds or a period of very dry weather just after planting. From field observations, planting out into cold, excessively wet, sticky, " puddled " or poor textured soils is also suspect. Frequently the grower's impatience to get the land ready for planting in spring tempts him to use tractors and implements while the soil is far too wet. These hasty cultivations may produce poor soil conditions for the development of new roots and the rapid establishment of the young plants.

Too Much Fertilizer Attention was also turned to the rates at which fertilizers are used on this crop. In addition to base dressings of compound fertilizers before planting out, top dressings of nitrogen are frequently given. In the Vale of Evesham, this top dressing is commonly applied as a handful of fertilizer thrown directly at the base of each plant, and in a few instances it has been over-liberal. It is suspected that such heavy applications might be directly or indirectly responsible for the incidence of whiptail.

Observations over several years showed that patches of plants with typical whiptail symptoms occurred on or near a headland, or in occasional lines across the field. On inquiry, there appeared to be some correlation between the appearance of the whiptail plants and the amount of fertilizer applied to those specific areas. In one instance the grower recalled that many whiptail plants developed on a patch of land where a heap of broken and damaged bags of fertilizer had been stacked and the contents spilled. A similar case was noted in which sacks of soot had been stacked near the headland for several weeks. On several farms, whiptail has appeared at the headland where the fertilizer drill had been halted for refilling. Again, the prevalence

of whiptail in whole rows of plants seemed to coincide with the application of double or treble doses of base fertilizer when the fertilizer drill accidentally traversed a strip of land more than once.

The limitations of such observations in the field were fully realized, but nevertheless they point to indiscriminate and excessively heavy dressings of fertilizer being a possible factor contributing to the incidence of whiptail. Trials to test these observations were accordingly laid down in Worcestershire in 1954 and repeated with modifications in 1955.

1954 Trials In the first year the plots were designed to see if extra heavy top dressings of nitrogen induced whiptail symptoms. The whole field had received a dressing of 10 tons farmyard manure, 10 cwt compound base fertilizer (N 7%; P_2O_5 7.0%; K_2O 10.5%) and 10 cwt ground limestone per acre. After adding the limestone, the pH of the soil was 6.8. To avoid possible molybdenum deficiency, the plants (variety, Snowball) were watered in the pots three weeks before planting out with a solution of sodium molybdate at the rate of 1 oz in 4 gallons of water to 1,500 plants.

The cauliflowers were planted out in mid-March, and three weeks later some of the plots were top dressed with 4 cwt "Nitro-Chalk" per acre placed in small heaps at the base of the plants. This dressing was repeated on some of the plots after a further three weeks, whilst others received their first top dressing of "Nitro-Chalk" at the rate of 8 cwt per acre at the same time.

In this experiment, in which all the plants were treated with molybdenum, no whiptail symptoms developed, in spite of the very heavy top dressings of nitrogen.

1955 Trials In the 1955 trials the experimental plots, each comprising 50 plants plus guard rows, were laid out in a section of a 30-acre field of cauliflowers. The whole field, including the experimental area, received a dressing of 10 tons farmyard manure and 10 cwt ground limestone per acre before the base dressings were applied to the experimental plots. Before the lime was added the pH of the soil was 6.73.

The seed (variety, Finney's 110) was sown at the end of September 1954, and the seedlings were put into 3-inch clay pots in October, in a compost consisting of steam-sterilized glasshouse border soil plus peat. The potted plants were stood pot-thick on the floor of the glasshouse until planting out time. Slight heat was given only in very cold weather. The seedlings were planted out in good weather on March 16.

In contrast to 1954, sodium molybdate was applied to only half the plants in the trial. The rate used was the same as the previous year and again the solution was given three weeks before planting out.

Base fertilizer treatment for the field took the form of a compound fertilizer having an analysis of 12% N, 12% P, 15% K, applied by hand on February 14. Three different rates were used—10 cwt per acre (3.7 oz. per sq. yd), 20 and 30 cwt. Subsequently the soil was cultivated to a depth of six inches.

For the final top dressing after planting, "Nitro-Chalk" was applied by hand in a band encircling each plant at a distance of about three inches from the base of the stem. Four rates were used:

1. Control—no top dressing.
2. 5 cwt per acre (¼ oz per plant) applied 3 weeks after planting.
3. 10 cwt per acre applied 3 weeks after planting.
4. 10 cwt per acre applied 6 weeks after planting.

The plots were so arranged that the effects of separate and combined treatments could be observed.

Molybdenum the Significant Factor A few weeks after the first top dressings whiptail symptoms began to appear in the plots which had received the heavier base and top dressings, but only in the plants which had not had the molybdenum treatment. The crop was recorded in mid-June, just before cutting, and whiptail symptoms were found in the untreated plants in varying amounts from 2 per cent to as high as 38 per cent. No whiptail appeared in the molybdenum-treated plants in any of the fertilizer treatments.

Effect of Fertilizers on the Occurrence of Whiptail in Early Cauliflowers not Treated with Molybdenum

Base Dressing	Top Dressing		Whiptail in Untreated Plants
	Rate	Period after Planting	
cwt	*cwt*	*weeks*	*per cent*
10	—	—	8
	5	3	10
	10	3	4
	10	6	2
20	—	—	8
	5	3	38
	10	3	20
	10	6	8
30	—	—	16
	5	3	36
	10	3	30
	10	6	8

NOTE: No whiptail occurred in any plants which had been treated with molybdenum three weeks before planting out.

From this observation trial, which, it must be stressed, was carried out once only, on one site and with one variety only, there appears to be some evidence that: (a) whiptail symptoms may be induced in early cauliflowers by heavy base and top dressings of inorganic fertilizers, if the plants have not received a special dressing of molybdenum in the early stages of growth; (b) cauliflower plants receiving a special dressing of molybdenum in an early stage of growth are apparently able to utilize, without harmful results, very heavy application of both base and top dressings of inorganic fertilizers.

Although it seems probable that different varieties and stocks vary in their susceptibility to the disorder known as whiptail, there is insufficient evidence available to us to make it possible to specify resistant or susceptible varieties.

Practical Steps to Prevent Whiptail Checks in the growth of the seedlings should be avoided. The seedbed should be adequately moist and well supplied with lime and phosphates. A shallow layer (2-3 inches) of John Innes compost over the soil in the frames or houses is a safeguard, but heavy dressings of nitrogenous fertilizer should be avoided at this stage. The plants should grow steadily during the winter months and, if possible, severe frosts should be kept out of the houses or frames.

WHIPTAIL OF EARLY CAULIFLOWER

The pH of the soil in the field should be not less than 6.5, and the physical condition of the soil at planting out time should be satisfactory. Even application of the base fertilizers is essential. At this stage it is perhaps premature to suggest the use of sodium molybdate as a routine measure to prevent whiptail, but it could be tried on holdings where whiptail has been troublesome in the past. If molybdenum is used, it is important not to exceed a dosage equivalent to 1 oz sodium molybdate in 4 gallons of water to 1,500 plants in 3-inch pots.

Thanks are due to Messrs. J. M. Stokes Ltd., White House Farm, Charlton, near Evesham, for their courtesy and co-operation in the two trials.

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AGRICULTURAL STATISTICS: ENGLAND AND WALES

CROPS GROWN IN GLASSHOUSES (a) (January 1956)

	January 1955	January 1956
	acres	*acres*
TOTAL AREA OF GLASSHOUSES		
With heating apparatus	3,889	3,824
Without heating apparatus	720	747
Total	**4,609**	**4,571**
CROPS IN GLASSHOUSES AT JANUARY 14		
Lettuce	505	529
French beans	3	3
Mushrooms	32	31
Other vegetables and herbs	65	64
Carnations	166	174
Roses	107	114
Orchids	10	10
Bulbs for forcing	(b)	167
All other flower and foliage crops	647	471
All other crops not specified above	348	329
Total	**1,883**	**1,892**
Remaining glasshouse area (being the area unused at January 14 or used for other purposes not shown above)	2,726	2,679
TOTAL AREA OF GLASSHOUSES	**4,609**	**4,571**
CHRYSANTHEMUMS IN GLASSHOUSES		
Area of chrysanthemums grown in autumn and winter	771	773
LETTUCE IN GLASSHOUSES		
Area of lettuce completely cleared before January 14	69	71
Area of lettuce as at January 14	505	529
Area of lettuce to be planted between January 15 and March 31	377	388

(a) Includes Dutch light structures which were glazed at the census date. All holdings with 1,000 square feet or more of glass are included. (b) Not collected separately in 1955.

CHAROLLAIS CATTLE

J. WORTHINGTON

National Agricultural Advisory Service, South-Eastern Province

THE mere thought of a tournedos, a chateaubriand or an entrecôte steak —beef at its very best, as I tasted them in Paris and Lyons—is enough to stimulate the gastric juices all over again. And it is almost certain that the animals which provided them came from some of the 250,000 Charollais cattle which annually supply the abattoirs of these two cities with 147,000 tons of meat, and that they were born and fattened in the country mid-way between.

The Charollais breed takes its name from the little town of Charolles, which lies between Paray-le-Monial on the main Paris-Lyons line (some people identify it with Clochemerle, the scene of the book of that name) and Cluny with its fabulous abbey. Doubtless the monks there made good use of the cattle as beasts of burden, for that then was their main purpose, and in the north of France it still is. When they are past work they are fattened on sugar beet pulp and grains.

Most Important of Native Breeds It was early in the eighteenth century that breeders in the Nivernais adopted the Charollais and began the process of selection that has made it the most important of all the native breeds. The degree of their success is shown by the extent of the area throughout which the Charollais has now established itself—from St. Etienne in the south-east, the Morvan on the east to the north of Bourges and west as far as the Vendée. Nevers remains the headquarters, where, in 1887, the first edition of the herd book was published.

The herd's characteristics are now fixed. They are briefly: colour—white or light wheaten; head—small, short, wide as to forehead; horns—round, white, tapered; ears—medium, thin and nearly hairless; eyes—large; cheeks —heavy; muzzle—broad; neck—short. The chest is deep, ribs round; the top and underline are horizontal, loins wide and thick; hips not too prominent but very wide, as is also the rump. The buttocks are characteristically deep, extending down to the hock. The legs are relatively short, well set and very powerful.

On such a foundation it should not be difficult to lay massive quantities of meat. It is claimed that cows average from 14 to 16 cwt, bulls from a ton to nearly 24 cwt; outstanding steers have exceeded 3,000 lb, whilst bullocks of fifteen months have weighed 11¼ cwt. At Buenos Aires, a young bull weighed 1,188 lb at twelve months: at the Paris Show, a fifteen-months-old bull scaled 1,540 lb. The meat yield is commonly 60 per cent, and has been known to exceed 68 per cent. The skin is thick and flexible, and the normal quantity of raw leather from a 20 cwt steer is 132 lb.

These particulars are extracted from the breed brochure, and they receive confirmation from transatlantic sources—Louisiana State University, Alabama Polytechnic and the Texas Agricultural Experimental Station. At the last-named, U.S. Charollais and cross-breds, more particularly the Charbras (that is, Charollais × Brahma) have proved superior to Herefords, Shorthorns, Aberdeen-Angus and various crosses in respect of weaning weight, average daily gain and final weight.

As a matter of interest, there is a Charollais Herd Society in the United States. The breed is claimed to be 31-32 pure. Its ancestors were bulls imported in 1923 and 1930, crossed and top-crossed on Shorthorns. In 1952, an enterprising smuggler brought a herd of French-bred Charollais across the Mexican-Louisiana border, but the authorities, on hearing of this flagrant flouting of the immigration and foot-and-mouth regulations, soon hustled them out again. As recently as a year ago, the President of the Export Syndicat, M. Emile Maurice, of Lurey-Lévy, saw them in the Sierra Madre at 6,500 feet. There were then some forty in all—four bulls, cows and calves —and good enough, he thought, to win in good company in France.

A Herd at Crecy Not quite fortuitously, I found myself last August in similar company, at Crecy, where I was introduced to a noted breeder of Charollais, Jean Naudin. He does not show—his cousin, Achille, is President of the judges' panel—but he regularly judges at the January shows in Moulins and Nevers. Even so, he was obviously proud of the bull "Gondin", a first prize winner at Paris. He caressed the animal's massive buttocks. The double thigh which characterizes the breed, was as prominent as in the best beef Shorthorns.

It was desperately hot as we wandered through the herd—a score or so of cows, all with calves nearby. There had been no rain since May. The herbage looked quite incapable of sustaining life, let alone condition. I recognized a few plants of creeping timothy, some dogstail and dwarf cocksfoot. I drew my companion's attention to what appeared to be ragwort. He was indignant: "Pas Senecio, pas toxique!" he exclaimed.

I apologized for the deficiency in my botany. Would he some time, I asked, give me a comprehensive list of the species composing the sward? Weeks later he did so in writing, and in Latin—very aptly, he thought, since his meadows had been sown during the time of Julius Caesar! For those interested, I append his list (in English): fiorin, perennial oat grass, cocksfoot, meadow fescue, smooth-stalked meadow grass, wild white and wild red clovers, wood pea, lady's smock, bindweed, dandelion and (apologetically) thistles. This is unpromising material for silage—but then, he does not make any.

Our agronomic discussion was interrupted by angry bellowing in two voices. He rushed off. I followed closely to the corner of the field where his land and his neighbour's joined at a communal pond. As we arrived, there was a roar of pain from an intruding bull, and "Gondin" returned, tail high, victorious. As his owner complimented him, I noticed that the animal was not ringed. A few moments later he had forgotten the incident and had resumed grazing. Truly, the Charollais is a docile breed.

There was no time to cover the whole farm of 400 acres, all old grass save for 30 acres of lucerne, 20 of barley and oats, some roots and, of course, a small field of wheat—to earn the subsidy. The cattle are outdoors practically all the year round. Altogether, there are 3 bulls and 70 cows. He reckons on at least 60 calves a year, and every autumn he has a sale of calves, male and female.

We saw a bunch of heifers by a dew-pond. On the pond were geese and the ubiquitous "Barbary" duck, or as we call them, Muscovies. Like the Charollais, they flourish and increase with the minimum of attention. So too do the turkeys, the local variety being Dindon Noir de Sologne. There are five working horses, Nivernais blacks, and four foals. There were no sheep, although a neighbour has a flock of Southdown imported in 1855.

The buildings are a mixture of reconditioned medieval and modern functional, asbestos and breeze. A disintegrating circular structure partly over-

grown with ivy intrigued me. M. Naudin explained that it had been the forge where the farm blacksmith used to shoe the ancestors of the present herd. Nowadays, they stand and move foursquare on their own sturdy feet, and die, not work, for their livings.

That evening we had, as part of a gargantuan dinner, a rump steak of immense thickness and surpassing succulence. *Vive le Charollais!*

TEACHING AGRICULTURE AT SCHOOL

JOHN AUDRIC

Headmaster, Lingfield Secondary School, Surrey

Towards the end of the last war, a course of agriculture was introduced into the syllabus at this secondary school. It was an immediate success. Since then the school farm has grown apace, and already nearly 300 former pupils have made farming their occupation.

THE three-year course in agriculture at Lingfield Secondary School was started from scratch. There was no farming equipment, no tools, building or livestock, and no stockman. Moreover, there was no money with which to purchase even a small quantity of stock or housing. All that was available was the school building and 9 acres of land. Today, we have over 20 acres, eight cows, six calves, twelve pigs and two hundred head of poultry, a model dairy, piggeries, a full-time stockman and a cottage. And the course is self-supporting. In the past ten years nearly three hundred boys and girls have left school and have taken up employment on farms all over Britain, as well as in the countries of the Commonwealth.

Our beginnings, then, were quite humble, but the children entered with enthusiasm into the keeping of livestock, and pig and poultry clubs were soon formed. As there were no funds available to buy stock, the children formed themselves into a committee of shareholders. They could belong to both clubs, or only one. Shares were issued in units of 1*s.* for the poultry club and 2*s.* 6*d.* for the pig club. This enabled a start to be made. The amount of the dividend paid on the shares depended upon the success of the club, and it was up to the pupils to see that the club was successful. They took their shareholding very seriously, but the situation was not without humour. One boy was overheard to remark that his share of the pig club was the pig's tail!

The necessary chicken-houses, fold units, and even pigsties, were constructed in the woodwork rooms, or bought at sales. As more stock was acquired, so the building programme developed.

We were very fortunate with feeding. Nearly all the pupils stayed to the school canteen dinner. Four hundred children are bound to leave some food, and this, with the waste incurred in the preparation of the meals, was a great help. Other feedingstuffs were grown to supplement the feed and to provide for the period when the canteen closed for the school holidays.

Soon we were recovering much of our capital outlay, and the shares were paying good dividends. As the clubs grew, so did the enterprise of the shareholders. For example, at Christmas time the various school societies hold their annual reunion dinner, and one astute member of the poultry club saw that these dinners afforded the club an excellent opportunity of in-

creasing their funds. "Why not," he said, "buy some day-old cockerels in the market next year—say, in May. We could buy heavy breeds at 6*d*. each, fatten them up, and sell them at Christmas for the society dinners."

It was a good idea, not only from a financial point of view but also from the educational angle as well, for the girls in the homecraft section would gain valuable experience in plucking, dressing and cooking the poultry. We let them go ahead. A hundred chicks were bought, and the result exceeded expectations.

Widening Experience But it was realized that in so far as practical experience was concerned, we needed something more than our resources would permit if the pupils were to gain the necessary insight into the work of a farm. Accordingly, local farmers were asked if the school could "adopt" their farms. All were eager to help. One farmer with 360 acres arranged a monthly visit so that we could observe the all-the-year-round working of a farm. For example, the October visit allowed us to see the lifting and clamping of mangolds and wheat sowing; November gave us a day with the threshing outfit; December provided a lesson in ploughing and setting out a field; January saw the first marketing of potatoes; and so on.

Other farms provided different experiences. One specialized in raising pedigree Sussex bulls, and here the farmer would parade the entire herd and so give us practice in stock-judging. A series of visits were made to a grassland farm, while not far away was a farm noted for the quality and length of the wool of the sheep.

The farmers gave us generous assistance in other ways. One presented us with a tractor, another with some calves, while all took a deep interest in our work.

Side by side with the farm adoption came the formation of a Young Farmers' Club. A senior section was formed for those who had left school. The members competed in the various county and national events, and one of our girls represented the county in the poultry plucking and trussing competitions at Olympia. On that occasion our farmer friends travelled with the school coach to give our representative moral support.

The school also exhibited at the Royal and other agricultural shows, and many hours were devoted to the preparation of the exhibits when school was closed for the day and at weekends.

Pupils from other Areas The activities were continually expanding. We started to rear our own calves and erect our own buildings, and all the time we were selling more and more bacon pigs. Boys and girls were also coming to us from the areas of other education authorities. The Surrey Education Committee built us a model dairy, supplied a stockman and built him a cottage, for the work had progressed to the stage when it could no longer be carried on without outside help.

What was particularly pleasing was the large number of boys and girls who were coming to us from the towns. Unfortunately, only a fraction of those who applied for admission could be accepted. As their homes were too far from the school for them to travel to school each day, they had to live in lodgings in the district. But accommodation was not easy to find, for landladies generally prefer to take adults. However, the parents of the local children are fortunately well disposed towards the school, and were prevailed upon to offer hospitality, so that some thirty homes were eventually forthcoming. Gradually we are adding to the number. For instance, some-

times we hear that an old boy is shortly to be called up, and this means that a spare bedroom may be available. The mother will frequently consent to take yet another enthusiastic recruit to farming.

Some of these new entrants came to us from grammar and boarding schools, and were of good intellectual attainment. This is quite a contrast to the position which existed before the war, when the boy who was low on the academic side was considered to be quite good enough for farming.

Three Hundred Recruits to Farming Our experience has shown us that far more boys and girls would take up farming if it were taught in schools. Many school-leavers are prepared to consider almost any opening, for they feel that a good, general education has fitted them for most things; but they avoid farming because they feel in their hearts that they know nothing about it. Give them this training, and their whole attitude changes. When they are within a month of leaving school, they usually advertise for a job in one of the agricultural journals, and few have so far had any difficulty in finding what they wanted.

Every year we hold a reunion dinner of past pupils. They travel considerable distances to this reunion, and many arrive early in the morning so that they can wander around the farm and look at the developments which have taken place since they were there. Many have gone far afield, because they have wanted to follow their particular interest in farming, and when it is time to sit down at table, they talk of the farms where they are working and of their hopes for their own smallholdings. As I listen to their lively chatter, I am proud of them. The charming young lady just three seats on my left, now married to a farmer, was the quiet little girl who was so good and quick at making butter, and the tough-looking young man at the end of the table has finished his military service and is back on his farm in Scotland as bailiff. He was the golden-haired leg-puller whose school days were often stormy. Letters from abroad are also read, for many have gone there and are doing well on the farms of the Commonwealth.

These former pupils have chosen their career and are happy in it. The school is proud that it guided them towards it. And, to judge from this small sample, Britain is indeed fortunate in the quality of the young men and women who are now seeking their careers on its farms.

Royal Show • **Newcastle-upon-Tyne** • **July 3-6**

MEAT FROM THE HILLS

Make a special point of seeing the Ministry's exhibit, which this year deals with the important subject of meat from the hills.

Stand No. 61 • **Block G** • **3rd Avenue**

EARLY POTATOES IN CORNWALL

KATHARINE H. JOHNSTONE, M.A., PH.D.

National Agricultural Advisory Service, South-Western Province

Curiously, little attention has been paid in the vast literature about potatoes to the cultivation of this crop in Cornwall. Yet potatoes have been grown there in quantity for some 200 years, in the main for the often profitable but exacting early market.

POTATOES became an established crop in Cornwall considerably earlier than in other parts of the south of England, probably during the second quarter of the eighteenth century. By 1750 they were being grown in large quantities in the Isles of Scilly (1), and eight years later Dr. William Borlase of Ludgvan, Penzance, described them as being "now everywhere grown" (2). There seems little doubt that potato growing in Cornwall derived from Ireland: trading connections were close and conditions and methods of farming similar. The open field system did not prevail in Cornwall, and potatoes fitted well into the system of enclosing land from the rough, "paring and burning", growing up to four arable crops, and then allowing it to lie for eight years before cropping again.

Two varieties were described by Borlase. One, a flat kidney, was planted in winter and lifted the following midsummer, and so was an early. Between 1780 and the end of the century considerable interest was taken in potato growing, stimulated, no doubt, by the frequent acute shortages of grain. One enthusiast, Vice-Admiral C. V. Penrose of Ethy, near Lostwithiel, carried out extensive trials and raised numerous seedlings. He gave detailed descriptions of three varieties to Worgan (3), who, in a book published soon after the turn of the century, mentions eight sorts of potatoes then commonly grown in Cornwall. As an early, Penrose favoured the Coppernose, also known as the London Kidney or Golden Dun. It was a white kidney potato, light purple at the rose end where the eyes were concentrated. When planting, the heel end was cut off and fed to pigs—probably the basis of the tradition, still existing, that it is beneficial to slice off the heel of a seed potato. This variety gave a wide range of seedlings and may have been a selection from, if not synonymous with, the Red-nosed Kidney, which was grown extensively at that time (4).

Incidentally, Penrose was interested in the advantages and disadvantages of banking, and observed that these potatoes must develop near the soil surface to reach perfection—a point echoed 150 years later by Mr. W. L. Thomas in his studies of early potato growing in Pembrokeshire. The Coppernose was evidently the early variety being grown in 1794 in west Cornwall, where we are told that two crops of potatoes were often produced from the same land in one year—a crop of earlies was lifted in May and the ground replanted with apple potatoes for early winter lifting (5).

Yields were surprisingly good in those far-off days, being around 4-5 tons per acre for earlies. They were produced either in beds of the lazy-bed type manured with dung and seaweed, as in west Cornwall, or ploughed in to six-furrow beds, as at Lostwithiel. Trouble was not unknown; "bobbin-joans" (premature tuber formation) seems to have been quite common in the Penzance area, and "the curl" (virus disease) was already a matter of concern.

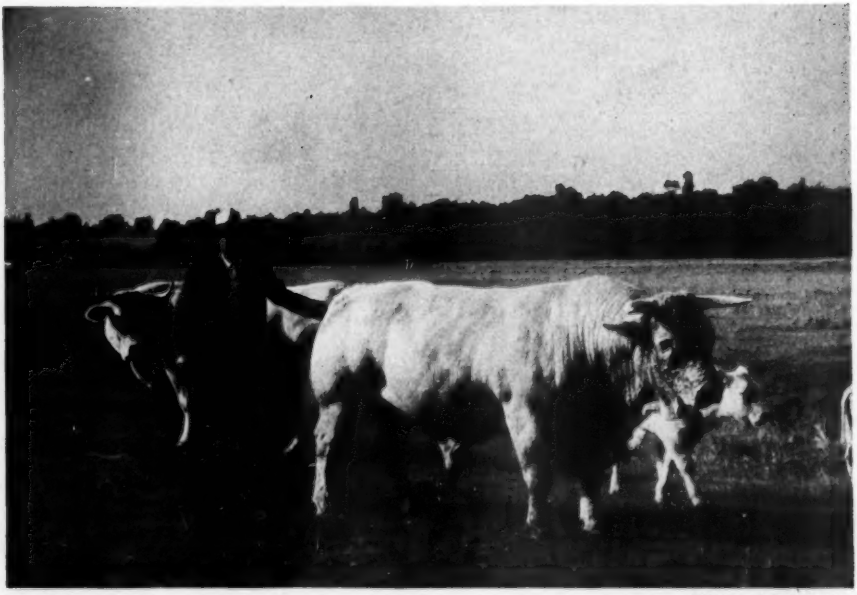
Nineteenth Century Development By the beginning of the nineteenth century many thousands of bushels of earlies were being sent by sea from west Cornwall to Plymouth and Ports-

Early potatoes in the cliff pockets on the Land's End peninsula.

Photos: *J. C. Dav*

Charollais Cattle (Article on pp. 119-21)

It is claimed that cows average from 14 to 16 cwt . . .



Photos: *J. Worthington*

. . . and bulls from a ton to nearly 24 cwt.

WIRRAL, CHES. Willaston Mill, worked by wind until 1911.

WOODBRIDGE, SUFFOLK. Burch Mill, later converted to a water tower.

BOSTON, LINCS. Six-sailed mill at Sibley. Built in 1877, it worked four pairs of stones.

SLEAFORD, LINCS. Heckington Mill, the only eight-sailer in England.

Photos: *E. Mitford Abraham*

Photo (*top*): *Paul Popper*

The Coypu and its Habitat

(Article on pp. 127-9)

mouth, and some to London, mainly between June and September. In 1837 a trial consignment of very early potatoes was sent from Penzance to London at the beginning of May (⁸), and met with great success. This was probably the first attempt to dispatch immature potatoes to compete with the new potatoes forced in frames by the London market gardeners.

It is difficult to identify the variety grown during this period; probably it was the Old Ashleaf, although some writers refer to the Cornish kidney as a distinct sort. Myatt's Ashleaf rose quickly to favour after its introduction in 1853 and was unrivalled in popularity for fifty or sixty years. This popularity doubtless fixed its features in the public mind as the characters of a "new potato"—a yellow-fleshed kidney of good flavour.

Meanwhile, the staple varieties for home consumption in Cornwall were the Painted Lords and Painted Ladies, which reigned supreme from the late eighteenth century until the great Potato Blight epidemics of 1845 and 1846. Disastrous as Blight was to maincrop potato production, and despite its appearance so early in the season in Cornwall, earlies could usually be lifted before damage occurred. Thus during the nineteenth century interest in early potatoes increased, though progress was not always smooth. Railway transport became available in 1859, but disputes and difficulties occurred even then, and as late as 1886 steam clippers were offering quicker transport in their daily sailings from Penzance to Garston than could the railways.

Competition from the Isles of Scilly developed in the 1880s, but the Cornish trade continued to expand, reaching a peak in 1903, when 6,300 tons were dispatched by rail. More serious competition from overseas, particularly France, then set in, and by 1930 only a few hundred tons of early potatoes were being marketed. The introduction of tariff duties in 1932 gave a stimulus to the industry which, by 1939, was putting on rail some 2,000 tons a year. High quality kidney potatoes were still the requirement, the most popular being May Queen, Dargill Early and Sharpe's Express.

For ten years following the outbreak of the Second World War potato production in Cornwall was phenomenal; loadings from Cornwall in 1948 were 51,500 tons of earlies grown all over the county, often on land which was far from suitable.

Production for the Early Market The return to settled peace-time conditions has emphasized the importance of real earliness in the potato crop. The price pattern nowadays usually shows a marked drop between June 8 and 15, so that profitability becomes a complex product of date of lifting and size of yield. Only exceptional yields and low costs justify production on medium-early land, so that early potato growing is limited to sheltered parts of south-west Cornwall, with a few outlying favoured pockets, as at Boscastle and Downderry.

In general, the earlier the land the less suitable it is to mechanized production methods. In the very early "cliff pocket" around the coast on the Land's End peninsula tiny plots have been brought into cultivation, their size and delimitation by dry stone walls and hedges suggesting very great antiquity. Here the work in growing potatoes is done entirely by hand. Planted just before or after Christmas, using the Cornish shovel, maximum output per square inch in the shortest possible time is essential. From 2-2½ tons of seed (cut) per acre, crops of 4-8 tons per acre can be lifted by the end of May or early June. But these liftings represent only a fraction of the total Cornish crop.

In rather less intensively cultivated but "market-garden" land, usually double-cropped with broccoli, horse and hand cultivation is used; and from

1½-2 tons of seed planted and ploughed in, 6-7 tons per acre may be lifted during the first part of June. More mechanized farm production on medium-early land is often on newly-broken leys. From a planting rate of 1 ton per acre, the crop is usually lifted in June when about 3½ tons are available. Only very high yields justify deferring lifting until late June or early July.

A feature of the potato haulm in the coastal districts of the south-west, as in the Isles of Scilly, is its very dwarf, short-noded growth. This feature, also seen in tropical highlands, has been attributed to the large amount of ultra-violet rays in the bright sunlight of the area. Yellowing of the newly-emerged shoots, which occurs occasionally in other parts of England, is common in Cornwall, and is associated with cold conditions and a temporary inability to obtain nitrogen. Whether or not this yellowing occurs, a top dressing of up to 6 cwt per acre nitrate of soda or "Nitro-Chalk" in two dressings is normally given, in addition to a generous basic manuring of dung and compound fertilizer. Long recognized as good local practice, this treatment has recently been shown by critical experiment in the Isles of Scilly to be fully justified. It is interesting to conjecture how far this need for extra nitrogen is associated with the short-noded type of plant and represents an interaction with the quality or length of daylight.

Once tuber formation has started, bulking is speedy, and sound judgment is needed to assess the most profitable time for lifting, with both price and crop yield changing from day to day. The yield can double in a week and prices may be halved in a day.

Today's Problems The industry today has many problems. Is the housewife still prepared to pay a premium for quality? And if this premium is only modest, can high quality potatoes be put on the market at a reasonable price? No modern variety seems altogether ideal. Arran Pilot, though a heavy cropper, is scarcely of good enough quality; Home Guard, popular with some growers, is neither a real first early nor a kidney. In this connection it is significant that local demand for seed of May Queen far outstrips the supply—and this for a sixty-year-old variety after scores of newer ones have been tried and found wanting.

The outstanding problem is how to adjust expensive growing and marketing methods to modern conditions ([7]). For example, spinning out, which has largely replaced the meticulous lifting methods which prevailed thirty years ago, often results in bruised or ruffled-skinned potatoes. Investigations, however, have shown little sign of serious deterioration in transit. Certainly there is a need for a light, inexpensive, rigid container to replace the ½-cwt sacks now in general use. The pre-war boxes and maund-baskets of long ago are altogether too costly for present-day marketing, in which freight charges form the most serious factor of all.

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THE COYPU

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The coypu, or nutria, is an aquatic rodent native to S. America, which, in the last quarter of a century, has become established in East Anglia. There is no evidence, however, that it should be proscribed as a pest.

FUR farming has been responsible for the introduction into our countryside of an interesting mammal—the coypu or nutria (*Myocastor coypus* Mol.). It is an aquatic rodent of the Hystricomorph or porcupine group and is native to South America, where there are said to be three sub-species. It differs from the porcupine, however, in a number of ways: it has no spines, the hind-feet are webbed and the female has dorsally-situated teats which enable the young to feed while the mother is in the water. It has a round, scaly tail and small ears, and its large, orange-coloured incisor teeth give it a rat-like appearance, although the snout is blunter than that of a rat. Because of its size (adults may weigh anything from 10 to 20 lb, or even more in some strains of the species), it is an impressive, even fierce-looking, creature. Occasionally it is exhibited in fairs and circuses as "the largest rat in the world", with lurid descriptions of where it was caught! Needless to say, these claims are nonsense.

The coypu came into Britain about 1930. By 1939 approximately forty "nutria" fur farms had been started, but during the war they were abandoned. Some of the animals undoubtedly escaped then, but others had escaped earlier, and a few wild coypus had been reported before 1939. They are now a firm feature of the Norfolk and Suffolk scene.

The introduction of any new species into an environment not its own may be dangerous. The best-known instances of this are the rabbit in Australia, the grey squirrel in Britain, the mongoose in the West Indies, and the musk-rat in Europe. The last-mentioned animal is an aquatic vole-like rodent, related to the water-vole, and therefore of the Myomorpha group of rodents. It is Nearctic in origin. It should never, as it sometimes is, be confused with the coypu. The musk-rat, also a fur-yielding animal, has become a pest on the European mainland and at one time threatened to become so in Britain. Fortunately, it was exterminated here before the Second World War. It is much more of a burrowing animal in its habits than the coypu, and therefore can cause severe damage to waterways and drainage. It is also considerably smaller than the coypu, being about three to four times as large as a common rat, and its tail is flattened laterally.

Little Agricultural Damage The coypu normally makes platform nests of herbaceous material above ground level. It may live in burrows under tree root, but does no really serious damage to dykes and river walls; records made by marshmen employed by the River Boards indicate that burrowing is not a common habit of coypus in this country. Generally speaking, therefore, they cannot be said to be endangering our drainage. The situations in which the creature does burrow would have to be studied closely for full understanding. The evidence from other countries into which the animal has been introduced—for example, Russia—suggests that it does not burrow to any marked extent unless there is no surface cover or deep water for protection.

The really notable effect which the coypu has is on the natural succession of aquatic vegetation, which provides its main food, its nesting material, and its hiding-place. Some local damage to agricultural crops, such as to sugar beet in autumn and winter, does occur, but not to an extent to justify widespread alarm. The coypu is mainly vegetarian, although in S. America it has been known to eat molluscs on the sea-shore. It has been recorded as a minor agricultural pest in the Argentine and in the Pacific north-west of the U.S.A., though there mainly in riverside vegetable gardens. It was introduced into the U.S.S.R. (Western Georgia) apparently intentionally, and in 1941 a Russian survey was published. This stated that the main food of the nutria was herbaceous water plants, chiefly the parts near the roots. The animals' grazing activity cleared the herbaceous vegetation over wide areas. Some maize and egg-plants were eaten in waterside fields, but the Russians concluded that it could not be regarded as a real agricultural pest. It was hunted by wolves, jackals, predatory birds, and even sheep-dogs.

In Britain, the coypu certainly grazes reed shoots (*Phragmites*). It cuts up the rhizomes and can convert the beds into open-water areas. It also pulls up reed-mace plants (*Typha*), eating the submerged parts and roots and leaving the rest floating. Rushes (*Juncus*) are treated in the same way. Other water plants—for example, sedges (*Cladium*), water-parsnip (*Sium*)—are also eaten, and sometimes aquatic grasses (*Glyceria*) are taken, though these seem to recover better from the grazing. If coypus are really numerous in a district, the reeds may be destroyed over some acres, but there is at present no real danger to the reed-cutting industry nor to the main flora of the area. Up to a point the opening-up of the water may even be a good thing, so long as the nutria's activities are kept within bounds.

No Great Increase in Population At present the coypu population is being controlled to an unknown extent by trapping. The price of a good skin has varied in recent years from about 35*s.* to 50*s.*, or even more at times, so that there is usually ample incentive to trap the animal. Young coypus are probably also taken by any predatory creature large enough to tackle them, such as stoats, and even herons. I have seen the corpse of a young coypu with the back of its skull broken open, and this could have been done by either a stoat or a heron. The large size and conspicuous appearance of the coypu make it vulnerable, except of course when it is swimming, for it is an accomplished diver. In spite of its appearance, the coypu is not a fierce animal, and is not difficult to trap. I do not think there is any need to conduct a systematic campaign against it but, if necessary, I believe it could easily be controlled or even exterminated.

The distribution of the nutria in Britain was studied by the Bureau of Animal Population between 1943 and 1945. Since then, its range has certainly extended, but no thorough survey has been made. In East Anglia the most southerly point where coypus have been seen is probably Holbrook, near Ipswich, and the most westerly is near Wisbech. The main centres are still in Norfolk and East Suffolk. Apparently isolated colonies, not always persisting, have been reported from time to time in other parts of England—for instance, near Slough in Buckinghamshire, and near Lewes in Sussex. One was also caught a few years ago near Bath. It is possible that occasional isolated captures have been animals which have escaped from circuses, private zoos or farms. No registration of nutria fur farms is required and therefore no up-to-date official list exists.

Despite the fact that the coypu has increased its range in recent years, there is still no evidence that its actual numbers are very much greater. A thorough survey and census would be needed to establish this for certain,

but in my opinion the habitat requirements of this rodent are too circumscribed for it ever to become as ubiquitous as other introduced species. It forms an interesting addition to our fauna and is worthy of serious study, but need not cause " alarm and despondency ".

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THE MINISTRY'S PUBLICATIONS

Since the list printed in the March 1956 issue of AGRICULTURE (p. 596) the undermentioned publications have been issued.

MAJOR PUBLICATIONS *Copies are obtainable at the prices quoted from Government Bookshops or through any bookseller.*

Bulletins

No. 159 Refrigerated Stores for Fruit (*New February 1956*) 2s. (2s. 2½d. by post)

Other Publications

Fatstock Guarantee Scheme 1956-57 (*New March 1956*) 1s. 6d. (1s. 7½d. by post)

LEAFLETS *Up to six single copies of Advisory and Animal Health Leaflets may be obtained free on application to the Ministry (Publications), Soho Square, London, W.1. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (4½d. by post).*

Advisory Leaflets

No. 43 Natural Hatching (*Revised January 1956*)
No. 270 Soil Analysis for Advisory Purposes (*Revised February 1956*)
No. 352 Commercial Violet Growing (*Revised January 1956*)
No. 397 Rearing Turkeys (*Revised March 1956*)

FREE ISSUES *Obtainable only from the Ministry (Publications), Soho Square, London, W.1.*

Growmore Leaflets

No. 28 How to make Silage (*Revised January 1956*)
No. 57 Tomato Growing in Gardens and Allotments (*Revised March 1956*)
No. 113 The Manuring of Gardens and Allotments (*New February 1956*)

Miscellaneous Leaflets

The Fatstock Guarantees 1956-57 (*New April 1956*)

WINDMILLS

E. MITFORD ABRAHAM

Once a familiar landmark of the British countryside, only a few windmills now remain as monuments to the skill of their builders and to a past age in the milling industry. Mr. Abraham here draws upon his extensive knowledge of the mills of this country, of which he has made a lifelong study.

HISTORY does not tell us when the first windmill was erected in England, but we do know that they existed in the twelfth century. The first authentic reference to one is at Bury St. Edmunds in 1191. In fact, windmills seem to have been developed more quickly in East Anglia and Lincolnshire than elsewhere, and, curiously enough, it is in that part of the country that most of the surviving mills can be seen regularly at work. Early in the last century there were 36,000 flour mills in Great Britain and Ireland. Most of them were worked by water, which was used for turning millstones some hundreds of years before wind power was harnessed. It is estimated, however, that there were some 5,000 windmills making flour in Great Britain and Ireland about 1825. Even as late as 1880, it is reckoned that flour was being made in over 7,000 mills, of which at least one-third were windmills.

It was about 1880 that the roller system of making flour was introduced here, as a result of a visit to Budapest by British and Irish millers in 1877. In a few instances, rollers were actually in use before then. One such mill was at Ingleborough, near Wisbech, where the tower of the fine six-sailed windmill remains today. The roller tattersall plant at Ingleborough could still be worked by wind when I first knew it, but, alas, an oil engine was eventually found to be more reliable than the vagaries of the wind. The change-over from millstones to rollers was, however, largely brought about by the large trade in Hungarian and American flour which developed during the latter part of the nineteenth century. Our millers soon saw that unless they changed their methods from stone-grinding to roller-grinding, their business would be lost.

Since those halcyon days of the 1800s, the number of mills has declined to almost negligible proportions in the British Isles. It is difficult to say exactly how many are being worked by windpower today, but there cannot be more than about twenty-five, although quite a number now powered by either oil or electricity are still grinding grain for farmers.

Post and Tower Mills Windmills are mainly of two kinds—post and tower. The former are those extremely attractive little wooden mills, with either an open timber-framed base or one surrounded by a circular brick wall. One of the earliest known drawings of a windmill in England, on the fourteenth century Walsoken brass in St. Margaret's Church, King's Lynn, is identifiable as a post mill.

In the earliest kind of post mill, the timber base was let into the ground. Later the base was raised a few feet on four small pillars; and later still (eighteenth century) the timber base and pillars were surrounded by a circular wall. The mill was pivoted to the wind by means of a strong pole, which was attached to the main shaft inside the mill and ran through the sloping steps to within a few inches of the ground. This pole was usually turned by hand, but in more recent times many post mills had automatic fantail windsetters attached to the pole.

For six centuries these picturesque post mills were typical of the English landscape, and it was not until the eighteenth century that the first tower windmill was built. Any tower windmill that can be seen today either took the place of a post mill or was built alongside the older building. Post mills were built mainly of oak; and magnificent oak it was, withstanding the wear and strain of hundreds of years of hard work. Such indeed was the quality of the timber that a few years ago one of these beautiful old mills in Sussex was pulled down to adorn a modern residence. There are still a few post mills at work in Suffolk today, but very few elsewhere.

Suffolk was essentially the county of the post mill. Friston (near Saxmundham) and Lyleham Green (near Diss on the Norfolk boundary) are two examples of post mills still being worked by wind. In both these mills only one pair of arms (sails) are used. Saxstead Green, near Woodbridge, is another good specimen. Although no longer working, it has been preserved by the Suffolk County Council. There is not a single post mill left standing in the north of England, but the remains of one open-type specimen have recently been bought for re-erection at the Kirk Museum, York. The City of York Corporation is also to preserve the five-sailed Holgate windmill. This mill ceased to be worked by wind in 1927, but an electric motor was put in and worked its four pairs of stones until 1932.

The tower windmill, which has a fixed body and a revolving top, was developed from a small mill, no bigger than a post mill, to the large ones so common in Lincolnshire and Norfolk. In this type the sails are kept square to the wind automatically by a fantail at the rear, driving the top through gearing. The largest, at Yarmouth, was 120 feet high. It was pulled down over fifty years ago. But some of the larger ones (85-90 feet high, excluding the roof) are still standing and working. Many of them were driven by five, six or eight sails, but there is only one eight-sailer left now, at Heckington, near Sleaford, Lincs. These large mills had up to six pairs of stones, and it was quite common to find four or five. When working to full capacity in a good wind, as many as five sacks (20 stones) of flour could be made from three pairs of stones in the course of an hour. I do not know of a single windmill making flour today, although occasionally some small roller flour plants have been built alongside the windmill, and the latter is still used for grinding barley, maize, oats, etc. I have seen them particularly in Lincolnshire and East Anglia, often with bread-making as a sideline.

The Passing Scene It would, of course, be idle to pretend that the windmill could ever regain its place in the rural scene. Having lost the flour trade, it is now faced with competition from the small oil engine working grinders for farmers. These small machines can easily be fixed in the farmer's barn or shed, and the saving in time and transport will easily compensate for the additional capital expenditure. But it is questionable whether his "home-made" meal is as good as that made by a miller using well-dressed horizontal millstones.

During the last ten years or so a great change has taken place in the supply of feedingstuffs to farmers. Generally speaking, the farmer of today can have everything delivered to his door if he so wishes. Flour millers (both in the country and at the ports) have taken the place of the small country grist mill and can supply every type of feedingstuff. Where, for example, pigs were usually fed in the old days on barley meal ground at the local water- or wind-mill, today compounders can sell to the farmer every kind of feedingstuff supplemented by all the necessary vitamins.

But why, even in the face of these modern developments, should the windmill become completely obsolete? Is not the wind a cheap source of

power? Unfortunately it is not, for the simple reason that the equipment needed to harness the wind is very expensive nowadays. A few years ago a fine Norfolk windmill with four large sails was seriously damaged. No sail was actually blown off, but many of the shutters (the parts of the sails which are closed to catch the wind) were blown away, and the fantail, which automatically moves the top of the mill and the sails to the wind, was badly damaged. The owner decided that one of the sails would have to be replaced, but found that to buy a new one and repair the other damage would cost nearly £200. He reluctantly decided to have all the sails taken down and to continue working with an oil engine only. There have been scores of similar cases during the last forty years. Soon, of course, there will be no millwrights left to make and erect these windmill arms. Similarly, a miller wanting his millstones re-dressed will also be in a difficult position, unless he can do the work himself.

A Few Remain It was stated recently that Kent still has seventeen windmills in working order. If this is so (and I rather doubt it), then Kent has more working windmills than any other county. There can be no more than six left in Lincolnshire, and there is not a single working windmill in Norfolk. Suffolk can boast three, and one is left in Nottinghamshire, although, owing to the recent death of the miller-owner, it has not been working. An appeal for a tenant has been made: it will be interesting to learn whether one can be found.

There is not a windmill of any type left working in the north of England. Skidby Mill, near Hull, is still standing and is in good order, but recently the owners most reluctantly came to the conclusion that it must be closed down, and this was done early last year. Windmills were formerly very prominent on the Lancashire and Cheshire coasts, and a number of ruined windmills can still be seen in the Fylde district of Lancashire. The last one to work was the restored Little Marton Mill, near Blackpool. This mill, which ceased operating in September 1928, is now owned and maintained by the Blackpool Corporation.

The windmills on the north-west coast of England were extremely interesting in comparison with those in East Anglia, for, in the past, they all made oatmeal for porridge and haverbread. Two pairs of stones were used exclusively for oatmeal and, generally speaking, two pairs of French burrs for grinding wheat into flour. The burrstones apparently came into use about two hundred years ago, the stone being imported from France but assembled and dressed in England. Several of the watermills in Furness, Westmorland and Cumberland, and a number of windmills in East Anglia, have actually turned over to electricity to work a hammer mill in place of the millstones. Speed seems to be the main reason, for a hammer mill can produce the meal five times faster. But surely no farmer will suggest that millstones can be superseded for quality!

Windmills and the Fens So far, only corn mills have been discussed, but the use of mills in the reclamation of the Fens must not be overlooked. The Earl of Bedford began this great work over 300 years ago, and brought over Dutch engineers to help him. The great work of draining the Fens into the three large tidal rivers—the Welland, Nene and Ouse—was pursued with much energy for many years, and eventually windmills were built to raise the water from artificial drains into higher drains, etc., and so into the rivers. The Dutch (from whom most probably we adopted the windmill) built no less than 400 windmills in the Fens. These were in use up to the end of the eighteenth century, when steam pumps erected on the river banks began to take their place.

Some of these Fenland windmills were eventually turned into corn mills. An extremely interesting example was that at Salter's Lode, near Downham Market, which ceased working in March 1924 after having been grinding grain and making flour from about 1850. Probably nothing now remains of it. Another interesting example was at Warboys, on the Ramsey Road in Huntingdonshire. One of the last windmills pumping water by wind power was at Soham Mere. For some years it was worked by a single pair of sails. It was dismantled because of its dangerous condition only a few years ago.

Many people associate windmills with the Norfolk Broads, but, as elsewhere, they are fast disappearing from the skyline. None is now worked by wind in Norfolk, but there are two still worked on the portion of the Broads which falls in Suffolk.

Preservation Efforts have been made through the Windmill Section of the Society for the Protection of Ancient Buildings to preserve some windmills from destruction. Quite a few in southern East Anglia have been saved, and in many cases owners of windmills have been helped financially by the Society to keep their mills in operation. In other instances, local committees have been formed and, with the help of public subscriptions, have been instrumental in saving and keeping in repair a number of mills. Several local authorities now own windmills as a result of such activities, and it is to be hoped that some more can be taken over in this way. The unique, eight-sailed mill at Heckington, near Sleaford, is one such example of a windmill owned by the County Council, and there is a fine four-sailed tower mill at Woodbridge which is being preserved by the Suffolk County Council. Several have been protected in Kent, but there is apparently less interest in the north. It seems a pity that efforts cannot be made to preserve that fine example of a tower mill at Thornton, near Fleetwood.

We want some mills protected not only as interesting landmarks, but also that we may see how our old millwrights used to build the sails to catch all the wind power they needed and pass that power on to the top stone of a pair. It will soon be impossible, I am afraid, to visit a windmill at work on a quiet day and wonder how such a slight wind can be made to work a pair of stones. The tower windmill at Pakenham, near Bury St. Edmunds, is a beautiful example of a well-oiled, well-fitted windmill. May it long continue!

The men who designed and built the windmills of Britain were among the finest craftsmen that we have ever known. That some of these windmills should be preserved is a fitting acknowledgment of our indebtedness to them, besides preserving a historical record of a fading era.

SHIFTING CULTIVATION IN AFRICA

L. LORD
Colonial Office

A review of Pierre de Schlippe's new book, *Shifting Cultivation in Africa: The Zande System of Agriculture.* (Routledge and Kegan Paul. 42*s.*)

THE primitive method of crop husbandry known as shifting cultivation persists, and continues to be important, in many tropical countries. Essentially it consists of cutting down to ground level the vegetation on a small plot of land, burning it *in situ* towards the end of the dry season, and scratching in the seed among the top soil and ashes at the beginning of the rains. Mixed crops are generally grown and a plot is cultivated for one, two or three years until the fertility declines and the competition of weeds becomes severe. A shift is then made to a new plot of land and the process repeated. A special form of shifting cultivation practised in Northern Rhodesia is known as *chitemene* cultivation and differs from the more common form in that additional vegetation is brought for burning to the plot to be cultivated.

Shifting cultivation, and particularly *chitemene*, has been criticized as being wasteful of land and resources because the fallow period required for the natural regeneration of the bush may be anything up to twenty years. Nevertheless, it plays a useful, and often essential, part in the transition to permanent, settled, farming. Among the points in its favour are that it can be practised by peasants without capital, except enough to cover the cost of an axe or heavy knife and, possibly, a hoe; and it is not dependent on cattle, either for cultivations or to furnish manure. The latter point is especially important, since large areas of Africa are infested with tse-tse fly, and cattle cannot be kept. The burning following felling (or grass cutting in the tall elephant-grass country) satisfactorily controls weed growth for one or two crops, and the fertility accumulated by fifteen to twenty years' growth of plants, some of which are deep-rooted, is adequate to produce two or three good crops.

Shifting cultivation, important as it has been and remains, is nevertheless only a phase in the evolution of farming systems, and the change to settled farming is being hastened by a number of factors. Amongst these may be instanced the increasing pressure of population, the provision of capital through governmental agencies, technical advances (including the introduction of mechanization), the development of grass leys in place of bush fallows, and the use of cattle manure, composts and fertilizers. To these may be added the organizational changes involving some form of group development, with the provision of central services such as contract ploughing, and the processing and marketing of produce.

Modernizing Primitive Agriculture Mr. Schlippe's book is about shifting cultivation as practised by one African tribe—the Azande—in a comparatively small area in Africa around the meeting place of the Sudan, the Belgian Congo and French Equatorial Africa. It deals with the life and agricultural practices of the Azande in very great detail, and the full account and the many excellent photographs give a very clear picture of shifting cultivation in this particular ecological zone of Africa. The study has been conducted in such detail that, as the

author states in his preface, the book "has grown into a study on the borderland between social anthropology and agronomy".

Presumably basing his argument on this largely factual survey of one particular tribe and area, the author suggests in his foreword that what he calls modern civilization has failed to improve African agriculture, and he promises a further book in which he proposes to try and answer the question "What should we do?". His assumption seems rather sweeping and not to take sufficient account of what has already been done in Africa, and in other countries where shifting cultivation has been or still is practised, in the development of improved agricultural systems.

Many examples may be cited to show how modern ideas are slowly being introduced into this primitive field. I shall content myself with mentioning six. First, there has been the development of the African Robusta coffee industry in the Bukoba District of Tanganyika (not very far from the area covered by Mr. Schlippe's study), where now over 50,000 African coffee-growers have formed over fifty co-operative societies, affiliated to the Bukoba Native Union and handling an annual crop of 12,000 tons. Then there are the development of mixed farming in the Northern Region of Nigeria, aided by the distribution of working cattle by the Department of Agriculture, together with the introduction of "plantation" or estate cultivation of tree crops in Eastern and Western Nigeria, under the aegis of the Regional Production and Development Boards, where the technical advantages of plantation management and organization can be harmonized with land tenure problems. Fourth on my list is the provision by Departments of Agriculture of central services as an aid to development. Such services range from tractor-hire facilities for rice-growing in Tanganyika, Sierra Leone and other territories, to pest and disease treatment of cocoa in the Gold Coast and Nigeria. The spectacular development of cotton as a cash crop in a permanent system of farming in Uganda is especially worthy of mention. There, a rotation of three years' cropping, followed by three years of grass ley or tumbledown fallow, is being more and more commonly adopted, no doubt influenced by the provision of tractor ploughing services. Lastly, there has been the construction of irrigation and drainage works to ensure adequate water control—chiefly for rice-growing.

This brief account of a few, out of many, examples of agricultural betterment in British Colonial territories has taken us away from the real subject of Mr. Schlippe's book; his detailed factual study, although of most value to those working in areas more or less similar to the Zande, should be found of general interest to agricultural and administrative officers, teachers and social anthropologists in all tropical territories where shifting cultivation is still practised.

FARMING AFFAIRS

Pig Progeny Testing Stations Details of the selected sites and design for the new pig progeny testing stations were recently announced by the Ministry of Agriculture and the Department of Agriculture for Scotland. There will be five stations in all—at Letchworth, Herts; Corsham, Wilts; Selby, Yorks; Sealand, North Wales; and Stirling, Scotland—and it is hoped that the first, at Selby, will be opened in the early part of 1957. The remaining four will follow shortly afterwards.

Each station will be capable of taking 400 pigs at a time (100 groups of 4 pigs from each mating), and every pig will be kept in a pen of its own, so that the amount of food which it consumes can be measured accurately. Danish experience has been taken into account, but the stations have been specially designed to meet British requirements and will not be copies of the Danish ones.

As previously announced, the stations will be under the control of an independent board of management composed of representatives of the various branches of the pig industry. The bodies to be represented have selected their members, and application will shortly be made to register the Board under the Companies Act.

Farm and Forest: 15. Ordering the Trees Last spring there was a serious shortage of suitable young trees for planting in shelter-belts and small woodlands. Nurserymen have done their best to ensure that sufficient stocks will be available for the next planting season, which runs from October 1956 to April 1957, but to make sure of getting what they want, farmers should order now. There is much to be said for going to a local nursery firm, since the trees raised will already be acclimatized to prevailing conditions. When ordering, make it clear at the outset that you want trees for *forest planting*; many firms also raise some species of forest trees for ornamental use in gardens, and as these need more attention, they naturally cost more. For the true forest trees, prices vary little throughout the country during any one year, since they are adjusted annually after consultations between representatives of the Forestry Commission, private woodland owners and the nursery trade. But of course transport charges have to be added, so generally it will pay you to go to the nearest firm (though good results can often be obtained with stock ordered from quite far afield, where this is necessary). Any firm will gladly send you its current price list.

There are two ways of defining the type of plant required—by age or by size. For the bulk of farm planting, what is wanted is a "transplant," or transplanted tree, between one and two feet tall. It may be described as a "one-plus-one" transplant, which means that it has spent one year in a seedbed and another in a transplant bed, or perhaps as a "two-plus-one", which is, of course, one year older. But size is more important here than age.

Most nurserymen will send you a few sample plants free of charge, before you place your order. Desirable points to look for in these sample trees are stoutness of stem, and abundance of short side roots. Slender plants, and those with few side roots, are less likely to thrive, or, for that matter, to withstand the shock of transplanting from the nursery. It is generally unwise to buy over-sized (say, over two feet) or over-age trees, even if they are offered cheaply. If samples are obtained, they should be retained until the main stock arrives, so that should any cause for complaint arise, the original specimens are available for comparison.

Delivery over short distances is commonly by lorry, but rail is usually employed for longer distances. Despite the higher cost, consignment by passenger train has much to commend it; everything depends on the planting stock arriving in good condition, and a few shillings saved on freight may prove to be very false economy. Let the supplier know well in advance when you require the trees, and how you wish them sent.

There are comparatively few firms specializing in the raising of trees for forest planting, and it is safe to say that all are experts at their job. They have a reputation to maintain for supplying trees that grow, and keep on growing for anything up to a hundred years or so. But they cannot be blamed if orders come in too late for the right type of tree to be selected, if they are asked to send trees long distances by slow goods trains, or if planting is hurriedly done right at the end of the season. The buyer can safely take the nurseryman into his confidence by describing the type of ground he has to plant; during the current shortage he might also usefully mention alternative trees species that will meet his need, so that the nurseryman may suggest, if necessary, acceptable substitutes. But do order early, so that the nurseryman has time to consider your needs and earmark the best trees for the job.

H. L. Edlin,
District Officer, Forestry Commission

At the Farmers' Club: FARMER AND BANKER

Mr. A. W. Tuke, Chairman of Barclays Bank, opened his paper on May 2nd by a quotation from William Lawson's *History of Banking*, written over a hundred years ago: " . . . for credit is a consequence, not a cause; the effect of a substance, not a substance; 'tis the sunshine, not the sun; . . . it is the oil of the wheel, the marrow in the bones, the blood in the veins, and the spirit in the heart of all the negotiations of trade, cash and commerce". Mr. Tuke was at pains to emphasize that credit is an *adjunct*, and not an alternative, to the farmer's capital. Bank advances can no more take the place of permanent capital than can forced products take the place of the main crop. He gave figures for the farming prosperity during and immediately after the war: the aggregate farming net income for the year to June 1, 1939, was £56½ millions, whilst for the year to June 1, 1947, it was £191½ millions. This was an increase of £135 millions and, even if the inflation of currency be discounted, there still appeared an increase of over 100 per cent in the real net income. By May 1953, the aggregate farming net income in the United Kingdom reached a peak of £333 millions. Bank advances to farmers in May 1953 were about £198 millions, as against £53 millions at the end of 1937—an increase in real accommodation of about 50 per cent.

Mr. Tuke claimed that inquiries in many districts have shown that there is no general shortage of working capital for farming along present lines. But, he asked, what about increased efficiency and greater productivity? The capital needed for long-term improvements has been variously estimated, but the figure of £400 million appears to be generally accepted. There is no shortage of capital for present needs, but there is a shortage for the purposes of carrying out all that ought to be done during the next several years.

On bank credit, Mr. Tuke had this to say: "It is axiomatic, of course, that in lending to farmers, as in lending to anybody else, the Bank is interested, firstly in its customer's integrity, and secondly in his ability, his standard of living, the nature of his farm, the amount of his permanent capital, and his experience in the business of farming. It is impossible to

say that there is any fixed principle in relation to security, as this depends so much on each individual case. Bankers' advances to farmers in their essence stand better without security than advances to almost any other industry in the country, for it can truly be said that a farmer is, by the nature of his occupation, more stable in his standard of finance than almost anyone else. Very many advances to farmers are unsecured in the banking sense. It is fortunate indeed that farmers are such trustworthy unsecured borrowers, as it is so often the case that tenant farmers have only their agricultural assets which they can offer; and these can be taken as security only by way of an Agricultural Charge, which is a procedure that a Bank would usually prefer to avoid."

" I would ask farmers," concluded Mr. Tuke, " to realize that the position of the Banks today and the continued ability of the Banks to assist agriculture to the extent they do, is attributable to the policy of liquidity which allows not of long-term fixed loans. Moreover, the history from the 1920s onwards, depressing as it was in the first half of the period, plainly shows two things: first, that the Banks have strained their functions to the uttermost to help farmers in difficult times; and second, that despite that degree of assistance, Bank advances have not amended, and can never amend, a lack of permanent capital.

"Finally, I will quote some words of Francis Quarles, a seventeenth century writer and one-time chronologer to the City of London:

> *See'st thou good dayes? Prepare for evil times: no summer but hath its winter. He never reaped comfort in adversity that sowed it not in prosperity.*

A Concrete Surface Silo One of the features of the 400-acre Ryecote Farm at Milton Common, Oxford, is the excellence of the fixed equipment, the fullest use being made throughout the year of every square inch of the many multi-purpose buildings. It is not surprising, therefore, that when the owners, Messrs. J. and P. Hedges, decided to erect a concrete silo they made a very good job of it. Before deciding to build this silo, Messrs. Hedges went to considerable lengths to weigh up the most economical method of conservation. A high water-table precluded the making of a pit, so their choice eventually fell upon an above-ground, walled clamp silo. This was built on a site adjoining the semi-covered and covered cattle yards so as to be as near the point of consumption as possible, and was designed to hold 200 tons of grass silage.

The structure consists basically of three walls, the north end being left open for filling. It can be emptied either from the open end or from a 10 feet gap in the east wall, which is closed with old railway sleepers during filling and storage. The walls are 5½ feet high, and taper from 2½ feet wide at the base to 1 foot wide at the top to allow for better consolidation. They are constructed of two 6-inch solid concrete block " skins ", the outer wall being built vertical and the inner wall sloped. The intervening space is filled with ballast. The foundation for the walls consists of a concrete raft 3½ feet wide by 1 foot thick, built on the clay subsoil.

The floor of the silo is made of a 6-inch thickness of concrete laid over a clinker base, with a fall of 2 inches to a centre gully. This gully is filled with washed flints and is constructed with a fall to discharge into a concrete catch-pit outside the main structure. The catch-pit is considered to be essential because of the lack of any natural fall-away from the silo.

It was originally intended to roof the whole silo by building a Dutch barn over it, but in view of the excellent product achieved last year using a straw covering, it is doubtful whether a more permanent roof is justified.

The owners were not, and are still not, convinced that there is much to be gained from self-feeding silage, but nevertheless they felt that provision should be made so that, if necessary, the practice could be adopted. Hence the decision to have the 10 feet gap in the east wall, which, after an initial cut had been made, would allow grazing on two faces. It has since been found that the gap considerably reduces the barrowing distance in the present feeding arrangements. It was also in the minds of the designers that the walled structure could be converted easily into a covered yard should silage-making ever be discontinued.

The width of 24 feet and the sloping sides seem ideal for proper consolidation, and although the consolidated silage did not quite reach the height of the walls last year, it is considered that the silo can be safely filled much higher than it was, giving a consolidated height at the sides of around 7½ feet.

What is the cost of such a silo? In this case the concreting and block work were carried out by a local builder with the help of some farm labour, and the structure cost around £400. A four-bay Dutch barn to cover the whole area would add a further £500 to the bill.

M. F. Glanville

Guernsey Tomatoes Tomatoes were being grown in Guernsey nearly a hundred years ago, although, of course, on a much smaller scale. Today 1,100 acres are covered with glass, and almost all of it is used for the production of tomatoes. The quantity exported in 1955 amounted to 50,530 tons—approximately equivalent to 9½ million 12 lb chips.

With few exceptions, Guernsey glasshouses are 30 feet wide. The original "vinery" (vines were grown in them before tomatoes) had very low sides, and as this was most inconvenient for growing tomatoes, many of these old houses have been raised about 4 feet or so and side framing put in. This operation was carried out without removing the glass—apart from a few panes at the bottom of the roof-bars—by means of an elaborate "jacking" system and much care and patience.

Soil sterilization, mainly by steam, has been practised for many years. The present method of "strip" steaming is a fairly recent development which saves labour and time. Lengthwise planting is standard practice and two rows are planted in the steamed strip; the pathway between the double rows is never cultivated. On at least half the total acreage the plants are set out in containers filled with soil from the steamed strip. These containers may be of metal, clay, concrete, cardboard or impregnated paper, and while their use involves greater attention to watering, it provides a method of controlling growth and makes it easier to get the required soil temperature. Heating pipes are spaced 5 feet apart across the house and the plants set out on either side.

The standard of cultivation in Guernsey is high and many of the growers well deserve the title of "tomato specialists". The average crop sold off the island is equivalent to an output of 45 tons per acre, but yields of 80-100 tons per acre are, in fact, achieved. Potentate is grown more than any other variety and, in the best hands, produces very good fruit. Some use has been made of artificial illumination in raising plants, but there seems to be some doubt, in this area of good light, whether the cost of treatment is fully justified.

All the marketing of the island's tomatoes must be done through the Guernsey Tomato Marketing Board. Grading and packing is the responsi-

bility of the individual growers, but a sample from every consignment must be examined and the grade agreed by the Board's Inspector before it is accepted. In the event of a consignment being rejected, the grower must take it away, re-grade and pack, and submit it again for examination. Colours and symbols are used to describe the six acceptable grades, but the "blue" of Guernsey denotes a small, smooth fruit, whereas "blue" in England is applied to the large, rough fruits.

Fruit is sent to every market in this country. All of it is conveyed to England by boat; charges for air transport are too high, even for the valuable early fruit. Much research into handling and stacking on boat and train has been, and is being, done to try and ensure that the fruit reaches the consumer in good condition. The economy of the island depends to a very large extent on the tomato industry, and every step is taken at all stages of production and marketing to ensure that the present high standard is maintained.

A. D. Harrison

Museum of English Rural Life. Report, 1955 Over four hundred guests were present at the formal opening to the public of the Museum, in Shinfield Park, Reading, on April 27, 1955. Between May and the end of the year the display rooms were visited by over 6,000 people. This is an excellent beginning, but it will not surprise anyone who has seen this collection of farming and rural equipment and accessories of bygone ages. The report states that during the year nearly 1,200 accessions have been made, and calls upon the staff for lectures and other forms of assistance have increased considerably; also many other museums are now referring specialist problems to Reading.

It is of interest to learn, too, that a number of research projects are in hand, which it is hoped will later form the basis of published Museum handbooks. The first of these is likely to be concerned with the evolution and development of the four-wheeled wagon; the second, with the functions and insignia of the eighteenth and nineteenth century village Friendly Societies in the West of England.

The exhibitions arranged for this year are: "Gardening in the Eighteenth Century" (June); "Woodware and Textiles" from the Welsh Folk Museum (July-August); and "Severn Fisheries" from the Gloucester Folk Museum (September-October).

Included in this report is an interesting shortened version of Mr. K. Uldall's lecture on the folk museums of Scandinavia, which shows very clearly the modern historiographical approach to the subject.

The report, obtainable from The Keeper of the Museum, 7 Shinfield Road, Reading, Berks, is priced 6*d*.

International Conference: Fernhurst The Second Plant Protection International Conference will be held at Fernhurst Research Station on June 19-21. Delegates from forty countries are expected to attend to hear and discuss papers given by eminent authorities in the field of crop protection. A report of this important conference will be published in the August issue of this JOURNAL.

IN BRIEF

Cheap Milk from Winter Rye

With grass being so much later this spring, many farmers in Glamorgan, particularly in the semi-hill districts around Neath, have been more appreciative than ever of their winter rye. These farmers have found that rye sown in August or September, with about 3 cwt of a complete compound fertilizer and followed by a top dressing of nitrogen in February, will provide grazing for dairy cows two or three weeks earlier than grass. Strip grazing starts usually in March, when the crop is 3-4 inches high, and a back fence is used to get a second grazing immediately after the first. In this way, continuous grazing is possible from March until well into May, providing sufficient for maintenance and at least three gallons of milk per cow at a feed cost of between 6*d*. and 7*d*. per gallon. Only a relatively small acreage of rye is necessary to provide this spring grazing, since about eight cows are carried per acre for the whole of the period. Total costs are about £12 per acre, but many farmers have obtained around 490 gallons per acre from this catch crop; it occupies the ground only from September to May and is thereafter ploughed and the land sown to kale. It has been noticed, too, that the cows do not appear to scour when first turned on to graze. This may be due to a higher SE/PE ratio than early grass.

S S S

World Ploughing Championship

The eyes of the agricultural world will be focused on the quiet little village of Warborough and Shillingford on October 10, 11 and 12, when the World Ploughing Championship is held on Mr. J. R. Warburton's Shillingford Farm. This will be the first time that the World Contest has been held in Great Britain. The first was held at Coburg, Ontario, in 1953, where it was won by Jim Eccles of Brampton, Ontario; 1954 at Killarney, Eire, by Hugh Barr of Coleraine, Northern Ireland; and last year, at Uppsala, Sweden, it was won again by Hugh Barr.

The Shillingford site is a medium heavy loam. On the first day a one-year ley will be ploughed and the second day will be stubble ploughing.

Many thousands of ploughmen will have taken part in the elimination bouts—at local, provincial and national levels—before the successful contestants put their ploughshares into the Shillingford loam. The trophy is the Golden Plough, donated by Esso world affiliates, a replica of an eighteenth century Norfolk plough. The winner holds it for a year, and is then presented with a miniature copy to keep.

The British Ploughing Championship will be competed for at the same time, to select two competitors to represent Great Britain in next year's World Contest to be held in Ohio, U.S.A., on September 19-20.

S S S

Hydraulic Tractor

A " new-look " in farm tractors may soon come out of research conducted at the National Institute of Agricultural Engineering. Mr. H. J. Hamblin of the Institute referred to it recently when he read his paper at the Institution of British Agricultural Engineers on the results of the application of hydrostatic transmission to tractors.

A prototype has been produced at Wrest Park and tested over a long period with successful results. The hydraulic motors are built into the driving wheels. There is no clutch or gear box and it has only one control to provide a variable speed. It can operate at very low speeds, and fuel consumption compares favourably with that of standard tractors. In addition, the new form of transmission allows a more open form of construction which gives the operator better visibility.

S S S

Wind and the Eelworm

When the light, sandy loams and black peat soils of Lincolnshire and East Anglia blow in strong winds, cysts of the Potato Root eelworm, Cereal Root eelworm and other similar species are often blown with them. Farm implements, boots and flood water are commonly accepted agents in the spreading of eelworm cysts, but it seems that under the dry conditions of the eastern counties, the wind may be of even greater importance.

On a farm in the Isle of Axholme three years ago, the N.A.A.S. began a small experiment. The soil here is a mixture of black peat and sand and readily blows during the critical months of March to May. Three metal traps were erected at heights of 6 inches, 2 feet and 3 feet above ground level in a corner of a field facing the (south-west) prevailing wind. A severe dust-storm at the end of March deposited several pounds of soil in these traps. From an examination of the numbers of eelworm cysts in the traps, it was estimated that about 1¼ million live Potato Root eelworm cysts were transported in 6 tons of soil over a front of one hundred yards.

S S S

More Milk in Russia

The number of cows in the Soviet Union is reported to have increased between October 1954 and October 1955 by 1.7 million, to a total of 29.2 million. Butter production in 1955, estimated at 436,000 tons, was 18 per cent higher than in the previous year, and cheese production rose by 22 per cent in the same period. The five-year plan for 1956-60 envisages an increase of 95 per cent in milk production, with the supply of butter and other dairy products raised by the milk equivalent of 25 million tons, or 86 per cent.

S S S

A Million Acres of Woodland

It was at Eggesford, midway between Exeter and Barnstaple, that the Forestry Commission made its first planting in 1919. On May 8 this year Her Majesty the Queen and His Royal Highness the Duke of Edinburgh each planted an oak tree on this historic spot to commemorate the planting by the Forestry Commission of a total of one million acres in Gt. Britain—an area larger than the whole of Kent.

S S S

Stoopless Milking

The elevated bail system of "stoopless" milking (so called because the operators stand below the milking platform and do not have to stoop or squat for any of the operations involved) is gaining popularity in New Zealand. The raised concrete platform on which the cows are milked runs the full length of the shed. The animals enter the bails from a concrete ramp leading up from a short control race, and leave the milking platform by another ramp at the farther end of the shed.

It is claimed that milking is much quicker, averaging ten or more cows per set of cups per hour, even in the early months. It is more hygienic because, to a large extent, the cows bail themselves and no leg ropes or chains are needed. The elimination of this preliminary work provides more time for close attention to milking technique, more effective udder washing, checking of mastitis, and other essential details. Not least, the system requires less labour.

Soil and Sense

Cash-cropping rotations remove far greater quantities of plant nutrients than the feeding rotations common in the last century; these losses can only be made good by fertilizers. Where the large amounts of nitrogen and potash needed are supplied, then satisfactory cash-cropping rotations can be established and maintained if particular care is taken with cultivations. If a continuous cash-cropping system is followed without proper manuring to replace the plant nutrients sold off the farm, then, sooner or later, the supplies of nutrients in the soil will decrease and crop yields will become uneconomic. There have been many examples, particularly on light land, where a heavy drain on meagre reserves of soil potassium, caused by arable cropping, has not been recognized in time. Discussions on cash cropping and fertilizers often lead to debates on " soil fertility " which merely cloud the issue.

The " fertility " of a soil means nothing more than its capacity to produce crops. Heavy cropping causes no damage to the soil which cannot be made good by modern methods of manuring and cultivating. The real purpose of fertilizers is not to maintain soil fertility, by substituting for so-called natural manures, but rather to increase fertility so that better kinds of crops can be grown in more productive and more profitable systems of farming.

G. W. Cooke, Agricultural Progress

Copper and Peat

Outstanding results have been obtained from applying copper to pastures on deep peat in trials conducted by the Rukuhia Soil Research Station, near Hamilton, North Island, New Zealand. In one recent trial on a very acid and fibrous peat, 30 feet deep, in the Waikato district, a dressing of as little as 5 lb copper sulphate an acre has given a 100 per cent increase in pasture growth and assured the establishment of a vigorous sward of ryegrass and white clover. Crops of maize and turnips grown on deep peat have also shown astonishing improvement.

The Rukuhia Research Station has been working for ten years on the problems of growing and maintaining a high-producing pasture on raw peat. It has completely reversed the concept and techniques for handling peat for pastoral purposes, and has also shown that it has potentials for specialized horticultural purposes. Peat is no longer the problem soil it once was.

The response to copper on peat will considerably enhance the productive potential of such soils, and has hastened the day when the many thousands of acres of raw peat in the Waikato and elsewhere can be considered for large-scale development.

BOOK REVIEWS

Some Economic Aspects of the Early Potato Crop in Cornwall, 1952-1954. HELEN M. COLE. Department of Economics, University of Bristol. 2*s.* 6*d.*

An investigation into early potato production in Cornwall was made by the Economics Department of Bristol University during the years 1952-54, when the industry was settling down, after abnormal, war-time conditions, to a new equilibrium of supply and demand. The first part of this informative booklet sets the national background against which this specialized local production must be seen, giving details of changes in supply (home-grown and imported) and of consumption. The second part shows the results of the survey in terms of inputs, returns, costs, margins and yields. Interest is added by comparing results for the intensive west Cornwall holdings with those on east Cornwall farms, where early potatoes form only a small part in an extensive farm system.

More detailed data are given in appendices, particularly about cultural practices. Those who regard potatoes as plants needing a husbandman's art rather than as economic units will feel how great a need there is for a survey of the whole field of experience and experiment in potato growing to combine with the economists' analyses.

The present survey fulfils its objective of providing basic data to help growers in their cropping policy and recommends the additional variable cost approach method. So great are the risks and so short and specialized the market for a crop of such high production costs, that it is to be hoped that the work will be continued to enhance the significance of means drawn from the immense range of variables affecting early potato growing in Cornwall.

Copies of the report may be obtained from the University of Bristol at 1 Courtenay Park, Newton Abbot, Devon.

K.H.J.

Mains-operated Electric Fence Controllers. (British Standard 2632:1955). British Standards Institution. 3*s.* 6*d.*

Mains-operated electric fence controllers have long been in use in continental Europe and America, sometimes almost to the exclusion of the battery-operated types. Until recently, British practice has almost wholly favoured the latter.

Choice of one type of controller as opposed to the other largely depends on the size and layout of the farm. The chief use of the mains controller is in the area fairly close to the mains supply. The longer the supply lines from controller to fields, the greater the possibility of faults. Thus it is mainly on the smaller farm that the mains controller can be used exclusively; for outlying fields the flexible battery types remain unchallenged. The chief advantage of the mains controller is that the trouble of maintaining batteries and their costly replacement is eliminated.

It is evident that mains controllers are now finding a place in British farming. Clearly, it is very desirable that a standard of safety should exist to protect the user, perhaps more so than for the battery-operated types. A committee, representing sixteen interested organizations, has therefore drawn up these requirements for construction, performance, testing and marking. Great care has been taken to ensure that mains controllers satisfying this standard are as safe as it is reasonably possible to make them, and it is true to say that manufacturers will not have an easy task in meeting all these demands. For example, the design must be such that it is impossible to touch live parts carrying mains electricity, and the output must not exceed a clearly defined maximum, irrespective of climatic conditions and faults. The same tests must again be satisfied after six months' continuous use.

The actual detailed requirements of the standard concern the manufacturer rather than the user. It is sufficient that the man in the field should know that such a standard exists to ensure his safety; but in his own interests he should satisfy himself that any mains controller he uses carries the certification mark of the British Standards Institution, indicating that it does comply with these very exacting safety requirements.

Copies of the standard may be obtained from the Institution, 2 Park Street, London, W.1.

C.L.

BOOK REVIEWS

The Agricultural History Review (Vol. IV, Pt. I). 12*s.* 6*d.*

Although barely four years old, the British Agricultural History Society has got away to a flying start. The membership has risen to 400, and the *Review* is being issued twice yearly.

And now, with all the verve and vigour of youth, the Society has sponsored an imaginative new enterprise which will surely appeal to all those "whose interest in agrarian history is most alert". Mr. H. P. R. Finberg, editor of the *Review*, introduces the project in the opening article of this issue. "It is proposed," he says, "to compile and publish an Agrarian History of England." At least seven, and possibly as many as twelve, volumes are envisaged and the work will extend over several years. Mr. Finberg anticipates that the project will arouse healthy controversy and, since he is also to be general editor of the History, readers of the *Review* should be assured a ringside view of the cut and thrust of the experts.

We have a foretaste of such controversy in Miss H. A. Beecham's article, "A Review of Balks as Strip Boundaries in the Open Fields". For almost a generation it was believed that green balks of turf separated the strips in the open fields system, and it was not until the publication, in 1938, of *The Open Fields* by Dr. and Mrs. Orwin that the idea was "relegated to mythology". In recent years, however, it has revived again and Miss Beecham sets out to lay the ghost for all time. She sifts the evidence almost word for word and mercilessly exposes the flaws in the arguments of Dr. Kerridge and his disciples. Those who believe that agrarian history is dull descriptive matter should certainly read this article.

In less controversial vein Mr. J. T. Coppock makes even agricultural returns seem interesting in his "Statistical Assessment of British Agriculture". Farmers may be surprised to learn, for instance, that the June agricultural returns began exactly ninety years ago. In view of the efforts involved, it is disappointing to hear that the returns "lie virtually unexploited". Perhaps Mr. Coppock will now help to remedy this.

Also included in this issue is an article by Mr. A. C. Todd on "An Answer to Poverty in Sussex 1830-45", and, as in previous issues, a very useful bibliography.

Details of the Society can be obtained from the Secretary, The Museum of English Rural Life, 7 Shinfield Road, Reading, Berks. Membership is open to all interested in agricultural history, the subscription is one guinea a year, and all members receive the *Review* free of charge.

B.E.C.

Successful Trapping Methods. WALTER S. CHANSLER. Macmillan. 25*s.*

Those parts of this book dealing with the natural history of the various animals are very good, giving, as they do, much accurate information of use to the field naturalist, as distinct from the trapper. Probably, the ordinary observer, having read this book, would find himself well enough equipped to get down to his job without undue delay or lack of confidence.

The main purpose of the book, however, is to give advice on the methods of trapping fur-bearing animals, and it is clear that the author is an expert in this field. But in most laymen the subject of trapping arouses feelings of distaste or unease, and to many connotes cruelty in greater or lesser degree. No reasonable person is likely to object to *necessary* trapping, provided always that the animals trapped are killed instantaneously or at least very quickly. I must confess that, in this connection, I found this otherwise excellent book unsatisfactory, and there are certain questions which jump to the mind but which are not answered by the author.

Just how much cruelty is involved in this kind of trapping? The following extract is not reassuring: "Muskrat and mink . . . will often twist off a foot within two or three hours after they get into the trap, especially if there are broken bones." Then, how frequently are the traps in a trap line visited by the trapper? I may have missed enlightenment on this particular question, but although I have read the book carefully, I can find no clear indication as to the answer. Does anything remain of the villainous, old-time practice of leaving trapped animals for a matter of days on endxdays possibly of mental and certainly of physical torture for the animals? If so, it is a high and unwarrantable price to pay for personal adornment.

The book is well produced. The many illustrations are rather crude but for the most part adequate.

F.H.L.

BOOK REVIEWS

Annual Report of the National Institute of Agricultural Engineering, 1955. 7*s.* 6*d.*

Every modern industry has its backroom boys, and the Annual Report from Wrest Park is a reminder that food-growing in this country is particularly well served in this respect. Although spectacular developments are not to be expected from the big guns in the farmer's armoury—tractor, combine, potato harvester and the rest—it is comforting to know that sustained effort and ingenuity of a high order are being applied to scores of projects, each having as its purpose an improvement of some feature of farming or horticultural equipment and each making a fascinating little story in its own right.

Under today's conditions, simple labour-saving must be the main purpose of mechanization, as it has been for so long, but it is clearly not the only one present in the minds of the Director of the N.I.A.E. and his staff: higher yields, better quality produce, and the safety and comfort (hence the efficiency) of the worker, are given close and patient study.

It is impressive to see the amount of basic research that is going forward—from the abrasion of metal by soils to the behaviour of heat, moisture and air in the greenhouse. Such work as this, long and tedious though it may be, provides the firmest of foundations on which to build codes of efficient practice.

Inspiring also is the record of help given to other countries who cannot yet hope to have the equivalent of an N.I.A.E. of their own. A groundnut harvester built at Wrest Park is on trial in Tanganyika; journeys were made to many distant lands by N.I.A.E. experts, and no fewer than 190 overseas visitors went to the Institute in the year under review. Obviously the Institute is making a massive contribution to the national prestige, and we should be proud of it.

Copies of the report may be obtained from the Institute at Wrest Park, Silsoe, Bedfordshire.

R.S.M.

Dairy Cattle: Selection, Feeding, and Management (4th Edition). W. W. YAPP and W. B. NEVENS. Chapman and Hall. 38*s.*

The products of the dairy cow form an important part of the human diet, and for this reason dairy farming is likely to remain a great and abiding industry. Thus it follows that any book which sets out clearly the principles of dairy farming, as this one does, will have a wide appeal. First published in 1926, *Dairy Cattle* has indeed proved a most popular text-book for the American student. The reason is not difficult to find, for throughout the work the authors have maintained a clear and direct treatment of their subject, and, in paragraphing the text, they have diligently followed a system of headings and sub-headings to throw into relief the main lesson from each section.

One subject with which this book deals—the preparation of animals for exhibition and sale—is not often found in agricultural text-books. The authors make the point that many people who decide to show their stock have their goals or standards raised while participating in shows, because they have the opportunity of viewing superior animals and of exchanging ideas with other exhibitors who have raised and shown the best animals.

Since this is an American publication, certain parts of it are of no direct use to readers in this country, particularly the chapters dealing with grassland, the production and conservation of food, rationing, dairy buildings and marketing. Nevertheless, though the systems outlined and the conditions of climate, soil, etc., are very different from those in this country, most of the principles stated are still applicable. The book is, therefore, likely to have a considerable derived value to dairy farmers and to students who are studying this subject at farm institutes or agricultural colleges.

The illustrations have been carefully chosen, though some of the photographs would have been more striking had they been larger. In one or two places, notably in the chapters dealing with breeding and milk secretion, greater clarity would have been achieved had the text been supplemented with line drawings.

The book ends with a reference to the wide opportunities offered by dairy farming. There is more to the meaning of the word " opportunity " than the mere reaping of financial rewards, and, as the authors so rightly point out, dairy farmers are in a favoured position, since, in principle, the type of farming they pursue is one which helps to ensure long-continued possession of their most priceless heritage—the soil.

J.K.L.

BOOK REVIEWS

Mechanical Aids to the Smallholding. DENYS DE SAULLES. Pearson. 12*s.* 6*d.*

The grower constantly faces the problem of timing his crops for the most profitable market, and, if soil or market conditions demand it, good mechanical equipment enables him to deal with as much as three days' work in one. Similar problems also have to be solved by the smallholder or even the owner of a large garden. Mechanization on the smallholding is a relatively neglected subject, and Mr. De Saulles is to be congratulated on packing a prodigious store of useful information into the 135 pages of this very readable book. There is an enormous range of equipment to cover and he has chosen his material carefully to cater for diverse interests.

The opening section of the book deals with the reasons for mechanization, suggests running costs for various machines, and discusses in a sensible and helpful manner the vexed questions of contract work and the co-operative ownership of equipment. Useful advice is given on choosing a light tractor, on horse-power requirements for various kinds of field work, and on the advantages of rotary cultivation. Some readers may not completely agree with the author's views on the last subject, but he makes a very important point when he reminds buyers that they should first check on the cost and availability of spares and on the maker's service facilities. Of equal importance is an alert and well-equipped local distributor who takes a pride in the after-sales service of his machines.

Other sections of the book cover ploughing and field work, machines for stock-keepers, transport equipment and workshop tools. Separate chapters review machines of special interest to the commercial grower and to the gardener, and there is a simple up-to-date account of both the basic theory and practical application of electricity on the land.

The concluding chapters show how the tractor works and how it should be maintained, with, finally, a complete survey of all small horticultural tractors and cultivators in current production.

The book is sure of a warm welcome for its straightforward style and the absence of complicated technical descriptions, which make so many text-books a black mystery to the uninitiated. The excellent illustrations include 67 photographs. It is a pity that there is no index; perhaps the next edition will be so provided, for it would be a great help in tracing details of machines and in comparing their respective merits.

K.G.B-C.

Grassland Farming. GEORGE H. SERVISS and GILBERT H. AHLGREN. Chapman and Hall. 24*s.*

Grassland Farming is one of the Farm Series books originally published by John Wiley of New York, and has been prepared primarily with a view to presenting modern grassland husbandry techniques to the American agricultural student at the (English) farm institute level of training, and also to farm workers and managers. With this aim in mind, the simplicity of its presentation is its commanding virtue. At the same time, it deals adequately with principles of food production which are of vital importance not only in the United States but throughout the world.

The book opens with a brief historical note on the course of farming development in the United States from early settlement to recent times. The now familiar background of the depletion of soil fertility by unsuitable cropping with no recourse to rotational farming is put forward as an example of the urgent need for suitable grassland husbandry techniques to be adopted under the varying conditions of soil and climate found over the North American continent. The role of grassland farming is stressed from two angles—stock feeding and soil fertility preservation.

In the two chapters concerned with suitable species for inclusion in seeds mixtures, pride of place is given to the legumes, so stressing the importance of this group of plants in the preservation of soil fertility and of high cropping potential under American conditions.

Later chapters deal with problems of seeds mixtures, establishment of swards, fertilizing, management, crop preservation and soil conservation practices, and also with the equipment necessary for grassland farming. The similarity of the whole theme to the concept of ley farming in this country will commend the book to those whose interests lie in this direction. A point of criticism is the repetition of subject-matter in one or two instances, but, as a whole, the book has a refreshingly easy style and fully attains the objective set by its authors.

G.P.H.

Soil Zoology: Proceedings of the University of Nottingham Second Easter School of Agricultural Science, 1955. Edited by D. KEITH MCE. KEVAN. Butterworths. 55*s.*

The title on the cover of this volume is simply "Soil Zoology", thus giving the impression that it is a text-book on the subject. This is unfortunate, because it is a useful work well able to stand on its own merits. It is true that the Editor makes the nature of the book clear in his preface, but some buyers will almost certainly be disappointed by the misleading title.

If the Editor is to be criticized on the matter of the title, he equally deserves to be congratulated on having otherwise done his work extremely well. The fifty-one papers on various aspects of soil zoology which were read at the Easter Conference at Nottingham in 1955 are reproduced in full, together with a selection of illustrations (both photographs and line drawings), a summary of the discussion, and extensive references. The Editor has himself contributed substantially to the scientific content of the book, and has put the whole together so that it is much more than the usual disjointed series of papers produced after similar conferences. There are, for instance, four indices: the first, listing authors, contains some 400 names, the index of animal genera runs to some 360 entries, and that of plant genera to about 80. The general index comprises 32 columns.

Though this is not a text-book, the papers cover almost all aspects of the subject. There is some unavoidable repetition, and several authors describe work, including methods of investigation, in which there is overlapping. Nevertheless, anyone interested in the soil will find the volume most useful, and even if he is not a specialist in zoology, he will not find it difficult reading. There are accounts of the fauna of different types of soil and litter in many parts of the world, the papers being divided into the following sections: Introductory, Pedology, Ecology, Applied, and those relating to Zoophagous Fungi.

Nearly a third of this book deals with investigation methods, particularly for sampling soil populations. It is clear that no one technique is suitable for all environments, and research workers will no doubt continue to produce their own modifications of existing methods, but a study of the papers presented here will show a new worker just how far his colleagues have progressed and so save him much unnecessary effort. Techniques for preserving and mounting soil organisms are given in detail—an extremely useful feature, since much of this information is otherwise difficult to find. Finally, there are valuable keys to many groups included in the soil fauna. These contain some familiar information as well as some which is new, but it is useful to have these aids to identification brought together in one volume.

K.M.

Pedigree Cattle Breeding. G. H. T. STOVIN. Crosby Lockwood. 12*s.* 6*d.*

Recent years have seen many books resplendent in bright and glossy dust covers and telling of the author's successful farming activities after years spent in some completely different vocation. Such stories are always stimulating and pleasant to read, but Dr. Stovin's book is exceptionally so. It is delightfully written by one who had long cherished an ambition to be a farmer, though destined by family tradition to enter the medical profession.

It was not until the war-time movement of population from the east coast had broken up his practice that Dr. Stovin achieved his ambition. He tells of his subsequent start on a smallholding of seven acres, of his anxieties and mistakes, and the eventual triumph over difficulties which gave him sufficient encouragement to enter into the occupation of a 365-acre farm. To have undertaken the extensive building operations which Dr. Stovin describes so amusingly and so well, must alone have needed considerable courage. Dr. Stovin has also developed the countryman's traditional habit of "looking over" his stock and crops—a practice which he justifies admirably in his chapter "The Value of Idling".

It is, of course, not unusual for a man with the strong personality and drive of Dr. Stovin to advance certain theories and ideas which will not find general agreement. Thus his arguments against showyard stock judging are not supported by the work of Rennie who, after his studies on 5,107 Jersey cows, maintained that a definite correlation exists between type and production. Contrary also to Dr. Stovin's belief, the average annual milk yield per cow in England and Wales has, in fact, risen by some 75 gallons during the past twenty years.

R.J.G.

Annual Farming Digest and Agricultural Directory of Scotland, 1956. Mearns Agricultural Publications. 10*s.* 6*d.*

When this directory first appeared last year it was widely acclaimed as an invaluable reference book for Scottish agriculturalists. It is to the publishers' credit that in the 1956 edition they have not been content to rest upon their laurels, but have added a number of new and interesting features. Among these may be briefly mentioned an illustrated survey, skilfully introduced by Dr. Ailan Fraser, of that very attractive part of Scotland, and, incidentally, the *locale* for this year's Royal Highland Show—Inverness. Also worthy of note is the breed section, containing notes on pedigree stock show points, prominent Scottish stock-breeding enterprises, and a geographically-arranged list of stock-breeders.

The directory is now divided into four parts, comprising an editorial, miscellany, reference section, information on breeds, and a buyers' guide. The varied collection of articles and notes contained in the first section provides material for hours of fascinating and informative reading, with the emphasis on the subject of increased production. But more prominence might, with advantage, have been given to the index, which is hidden behind the advertisements at the back. This, after all, is the key which decides the ultimate value of any book of reference.

As the Duke of Buccleuch points out in his foreword, agriculture holds a commanding position in Scotland, its output exceeding in value any three or four of the other basic industries combined. It is fitting, therefore, that the worker in this premier enterprise should have so complete a tool as this directory at his disposal, and that the visitor should be able to obtain such a fine introduction to Scottish agriculture before he even sets foot over the border.

L.W.T.

A Statistical Study of Livestock Production and Marketing. CLIFFORD HILDRETH and F. G. JARRETT. Chapman and Hall. 36*s.*

This monograph presents the results of a research project undertaken at the Cowles Commission for Research in Economics and aimed at studying the economic relations underlying the operation of livestock markets in the U.S.A. during the years 1920-49. As the title suggests, it is in no sense light reading, but a book for the specialist. The reason for the study was, in the first instance, methodological, and it should prove of considerable interest to those engaged in the application of statistical methods to economic problems. The tentative empirical results obtained should also interest agricultural economists.

While the ultimate purpose of this research was to obtain quantitative measures of some of the relations determining quantity and price of livestock products, the study seeks to formulate ideas about market behaviour, testing and reformulating these ideas where possible.

Livestock products—cattle, sheep, pigs, poultry, milk and eggs—are throughout considered only in aggregate. In the economic model used as a basis, the production of livestock products in a year is regarded as primarily determined by the amount of feed given to livestock in that year and the number of animals on farms at the beginning of the year. This relation is subsequently developed to take account of the diversity of livestock feeds. Further relations are introduced, involving the price of livestock products, the price of feed, supply and demand of feed (protein and grain separately), and consumer income. Indices for the aggregates over the whole livestock field for each of these variables are constructed for the thirty-year period.

Throughout the analysis two parallel methods are used to estimate the coefficients of the various terms. One, known as the limited information method, is illustrated in considerable detail in the appendix, while the other is the ordinary least squares method.

Various alternative forms of the relationships (both mathematical and economic) are investigated in an attempt to secure complete plausibility of results. Finally, the best versions of these fitted equations are used with fair success to estimate the subsequently known values of the indices for 1950.

Many problems for future investigation are posed, but of particular note is the contrast between the highly developed statistical methods which are used and the rather uncertain mathematical form of the relationships which are examined.

D.D.F.

Lily Year Book, 1956.
Daffodil and Tulip Year Book, 1956.

Royal Horticultural Society. 10*s.* each (10*s.* 9*d.* by post).

It is always a source of wonder to the non-specialist that the editors of the Royal Horticultural Society's year books are able to gather together enough material to fill a volume every year. Sometimes, it must be admitted, the articles, although meaty enough for real lovers of the flower concerned, seem to be a trifle slight to the eye of one who is not enthralled by the particular genus.

This year, however, there is more exciting material, and even the garden-owner whose tastes do not run to specialization could enjoy many of the articles. The lily enthusiasts had two thrills recently: the arrival of a new lily—an epiphytic lily at that—and of a tetraploid lily, a large-flowered edition of *Lilium longiflorum*. Even if our gardens are unlikely to derive much immediate benefit from the former, the possibilities opened up for the breeders by diploid and tetraploid lilies are considerable.

That there is room for endless discussion on lilies is shown by the symposium of articles by five lily enthusiasts who were each asked to name their five favourites. Only *L. szovitsianum* and *L. testaceum* appeared in as many as three lists; *L. brownii*, *L. wardii*, and *L. martagon album* each appeared in two lists. The other thirteen lilies named were all different.

Of more general interest is Mrs. Constance Spry's delightful article "Lilies in Decoration", and there is a goodly collection of experiences with lilies from many parts of the world.

The *Daffodil and Tulip Year Book* has a wider field of interest, and Mr. F. A. Secrett's review of the commercial development of daffodils during the past fifty years stresses the importance to the florist of these lovely flowers. Scent in daffodils, as in other flowers, seems to be an elusive characteristic when the hybridizers get to work, and if the article on this subject does not tell us how to breed for scent, it at least emphasizes an aspect of plant breeding that could do with more attention. A valuable part of this book is that which records the results of various ballots to determine the popularity of daffodil varieties for various purposes. It appears that a golden trumpet daffodil is still nearer to most people's heart than any other, and at the moment the variety "Kingscourt" is the public's darling. Women, as might be expected, see beauty in daffodils a little differently from men. The tulip is rather poorly served in this issue, but nevertheless it is a good and very interesting volume. As with all the Royal Horticultural Society's publications, the editing and production are of the highest order.

R.H.

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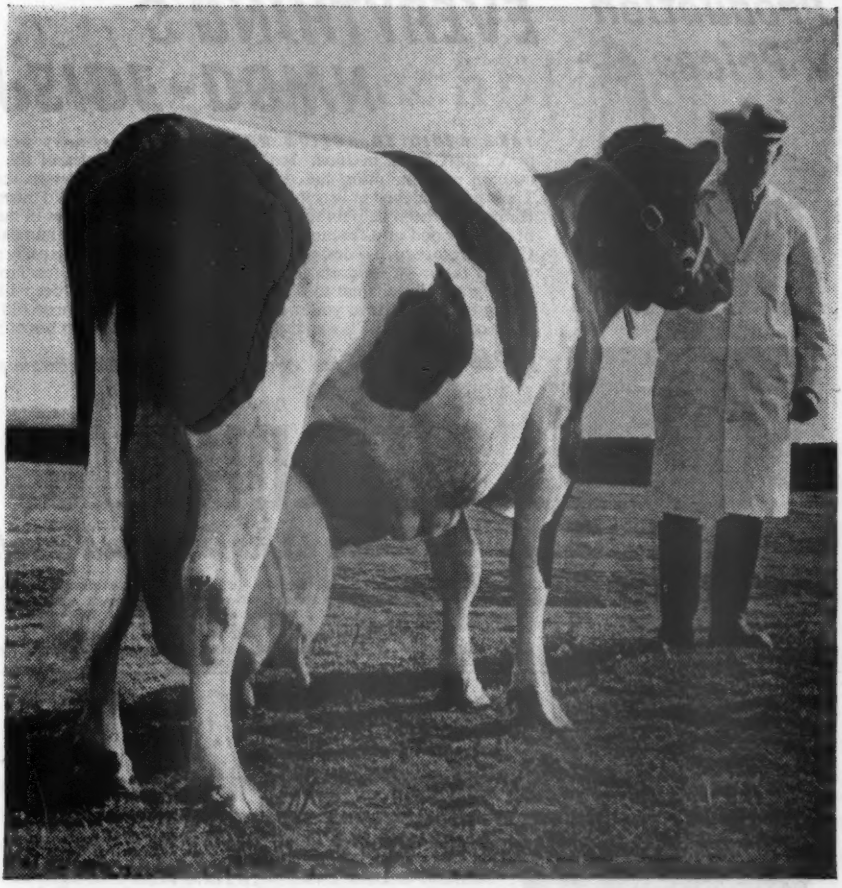

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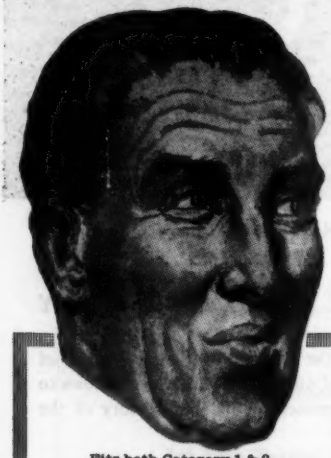

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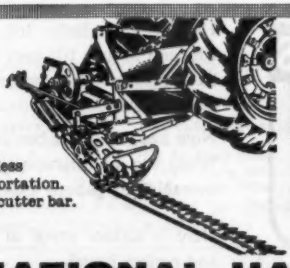

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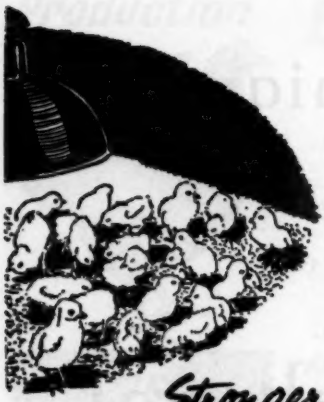

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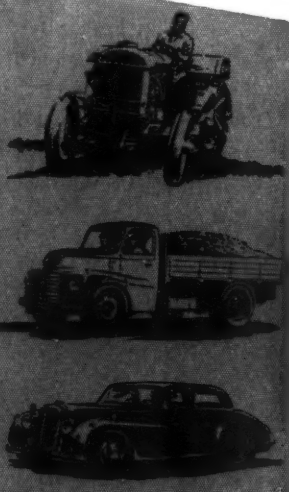

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